

**Wyoming's 2008 305(b)  
Integrated State Water Quality Assessment Report  
and  
2008 303(d) List  
of Waters Requiring TMDLs**



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# Executive Summary

Wyoming's 2008 Integrated Water Quality Assessment Report (305(b) Report) presents a summary of water quality conditions in the state, as required by Section 305(b) of the Clean Water Act (CWA). Included in this report is Wyoming's 2008 303(d) List of Waters Requiring TMDLs (303(d) List).

EPA's guidance for the 2008 305(b) Report asks that the same assessment methodology be used for both the 305(b) Report and the 303(d) List, and that the methodology used is developed with opportunity for public comment (USEPA, 2006; 2005; 2002). The Assessment Methodology was updated, using a public review process for the 2008 Integrated Report cycle. The new Assessment Methodology emphasizes the use of objective and representative data collection and assessments to make use support determinations using a weight-of-evidence approach, is consistent with Wyoming's Water Quality Standards and Wyoming's "credible data" law, and recognizes there are cases when use support determinations cannot always be made with existing data.

Once use support determinations are made, EPA's guidance for the 2008 305(b) Report asks that all waters of the state be placed into one of five categories of use attainment.

1. All designated uses are met.
2. Some designated uses met, but unknown on others.
3. Insufficient data to determine if any designated uses are met.
4. Water is impaired or threatened but a TMDL is not needed.
5. TMDLs are needed. The 303(d) List.

The federal Section 305(b) guidance also requests that this report contain updates on programmatic changes and water quality issues in the state. Since the last 305(b) Report, Wyoming Department of Environmental Quality - Water Quality Division (DEQ) has updated Water Quality Rules and Regulations Chapter 1, Wyoming Surface Water Quality Standards (Chapter 1). The primary changes to Chapter 1 were a change from fecal coliform to *Escherichia coli* (*E. coli*) criteria to determine contact recreation use support and the addition of a secondary contact recreation use for those waters which pose a lesser threat to public health.

DEQ has continued to monitor ambient water quality as part of its comprehensive monitoring effort. Assessments on 7343 miles of streams and rivers are included in this report. The expanding coal bed methane (CBM), also called coal bed natural gas, industry in Wyoming has generated a number of concerns regarding potential water quality impacts which are being addressed by DEQ.

# Water Quality Assessment

## Wyoming's Method for Determining Water Quality Condition of Surface Water

United States Environmental Protection Agency (EPA) guidance and DEQ policy are to use the same assessment methodology to develop both the 303(d) List and the 305(b) Report. "Wyoming's Method for Determining Water Quality Condition of Surface Waters and TMDL Prioritization for 303(d) Listed Waters" (Assessment Methodology) has been the guiding document outlining the criteria and decision-making processes employed by DEQ for the purpose of making designated use support determinations about the water quality of surface waters of the state. Wyoming began using the same assessment methodology for both the 305(b) and 303(d) processes in 2000. This methodology is publicly reviewed and meets all requirements of Wyoming's "credible data" law. This methodology was updated in 2002 and was used for the 2002, 2004 and 2006 305(b) Reports and the 303(d) Lists. In 2007, the Assessment Methodology was updated to be consistent with the water quality standards and to describe the data and scientific assessment requirements necessary to make use support determinations. The Assessment Methodology was updated with input from a committee of TMDL Workgroup members, and was released for public comment in August 2007. After reviewing and incorporating appropriate public comments, the Assessment Methodology was finalized in early 2008 (DEQ, 2008). The Assessment Methodology and the Response to Comments are available on the DEQ-WQD Website <http://deq.state.wy.us/wqd.htm>. This methodology was used to develop the 2008 305(b) Report and the 303(d) List.

### Changes to the Assessment Methodology

Changes to the Assessment Methodology from the 2002 version include:

#### Consistency with water quality standards and criteria

A numeric criterion is comprised of a quantifiable unit of measurement, and a duration and frequency of exposure. What constitutes an exceedence of numeric criteria varies for each designated use and is defined in Chapter 1 (e.g., criteria for aquatic life allows for one exceedence of a numeric criterion in 3 years, but criteria for drinking water do not allow for any exceedence of a numeric criterion). However, in the previous Assessment Methodologies, impairment was defined as when more than 10% of the samples exceeded the applicable criterion. Portions of that methodology conflicted with Chapter 1, so the Assessment Methodology was updated to be consistent with the water quality standards.

#### Objective and representative data collection and interpretation

When conducting water quality assessments, the evaluation must ensure that the cumulative data be spatially and temporally representative. Assessments of full use support must include representative data collected when the potential for non-support is greatest, based on a scientific and logical review of available data and considerations of soil, geology, hydrology, geomorphology, climate, stream succession and the influences of man upon the system. An assessment should include a description of the scientific logic used to determine that the data are spatially and temporally representative, including when the potential for non-support is greatest. Often this involves some type of statistical analysis of the data, based on sample variability and frequency and timing of sample collection. Additionally, even if data show numeric criteria are met for one or more parameters, those data alone may not necessarily prove the designated use is fully supported. In order to show full support for a designated use, a complete suite of "credible data" must be evaluated, and generally all numeric and narrative criteria must be met, based on a weight-of-evidence analysis.

## Weight-of-evidence assessment

Chapter 1 requires a weight-of-evidence approach utilizing “credible data” to make use support determinations. Weight-of-evidence is a rational thought process which incorporates all available data and uses scientific logic to determine which data are most relevant or important, and gives more weight to those most relevant data. Weight-of-evidence is not a cookie cutter approach but requires a clear understanding of how chemical, physical, biological and other factors interrelate in the surface water system. When applying a weight-of-evidence approach, DEQ will not presumptively favor one type of data over another but will examine a collection of data and information and apply a relative “weight” or importance to each relevant part according to the specific circumstances. Higher weights are typically given to objective and representative quantifiable measures which directly relate to the water quality condition of concern. For example, if physical degradation is the primary concern, more weight may be given to quantified measurements of bank erosion and channel geomorphology than water chemistry. Likewise, if chemical discharges are the primary concern, more weight may be given to chemical data and biological integrity than to channel geomorphology. Higher weights are also given to parameters which serve as long term indicators of environmental health, such as aquatic macroinvertebrate community structure. All three water quality categories - chemical, physical and biological - need not show an exceedence in order to determine that a water is impaired. If any one of the three has a parameter that exceeds a criterion, the water could be assessed as impaired after reviewing the weight-of-evidence of other relevant data. However, in most cases, an exceedence of a criterion in one water quality category will generally correspond with exceedences of criteria in other water quality categories due to the interrelationships between chemical, physical and biological water quality parameters.

## Use Support Determination

A determination of *attainment* or *non-attainment* is made for each designated use after comparing data with applicable criteria for all parameters using the weight-of-evidence approach. There often is not a clear distinction between attainment and non-attainment of designated uses. In some cases obvious stressors and/or somewhat degraded conditions are present, however use support remains unclear. In general, these waters have an *undetermined* status as the result of limited or conflicting data and/or the obvious presence of non-anthropogenic environmental stressors such as drought, wildlife influences or fire. When data are conflicting or too limited to make a defensible use support determination, future monitoring will generally be scheduled. The determination of designated use support is based on the following general guidelines:

### Attainment

**Full Support:** Based on a weight-of-evidence assessment, for all pollutants, no more than the allowable number (Chapter 1) of numeric criteria exceedences within a 3-year period. In addition no other representatively sampled water quality parameters, physical response indicators, or biological response indicators identify impairment. Representatively sampled parameters and indicators include sampling when potential for non-support is greatest, based on review of available data and considerations of soil, geology, hydrology, geomorphology, climate, stream succession and the influences of man upon the system. All other information suggests full use support.

### Undetermined

Based on a weight-of-evidence assessment, data do not indicate exceedences of numeric criteria. However one or more of the following conditions have been noted: data are not spatially and/or temporally representative of actual water quality conditions to make a full support determination; data and supporting information are unclear; or obvious stressors are present but it is unclear if data are beyond the range of natural conditions.

### Non-attainment

Fully Supporting but Threatened: No data types indicate exceedences of numeric or narrative criteria, but data do show a declining trend in water quality, physical response indicators, or biological response indicators suggesting a condition of non-support is likely to occur in the next two years, based on a weight-of-evidence assessment.

Not Fully Supporting: Based on a weight-of-evidence assessment, data and supporting information show use support is outside the natural range of conditions expected for that water, and/or numeric criteria applicable to that designated use are exceeded in frequency more than allowed by Chapter 1 within a 3-year period.

Regardless of which non attainment category a 303(d) “listed water” is placed in - threatened or not fully-supporting - the goals and requirements for that water will be consistently applied according to both the CWA and DEQ policy, and may be reevaluated as new information becomes available for a more comprehensive determination.

## **Water Quality Monitoring**

### **Water Quality Monitoring Strategy for 2004-2008**

DEQ develops five-year strategies to monitor water quality across the state. The current strategy (2004-2008) was designed to address the water quality issues facing Wyoming, while also complying with requirements of the CWA and recent EPA guidance relating to the ten critical elements of a state water monitoring and assessment program. The monitoring strategy builds upon the previous monitoring plan in place from 1998 through 2002 by incorporating multiple new approaches that together will lead toward a more complete, comprehensive monitoring program that addresses all waters of the state. Key new pieces of the strategy include an increased focus on monitoring all water types, including lake monitoring and development of wetland monitoring methodology, as well as a component that involves randomized selection of monitoring sites. The complete strategy document can be accessed at the following URL:  
<http://deq.state.wy.us/wqd/watershed/Downloads/Monitoring/4-0661doc.pdf>

### **2006 and 2007 Monitoring Seasons**

The five primary objectives for the 2006 and 2007 field seasons were:

- 1) Collect supplemental data for streams where existing data is not sufficient for a conclusive determination of designated use support.
- 2) Continue sampling historic reference stations; identify and sample new reference stations to fill data gaps.
- 3) Sample stations selected with probability (random) survey design
- 4) Conduct reservoir monitoring on selected large reservoirs as part of the large reservoir sampling rotation.
- 5) Monitor streams currently on the 303(d) list to evaluate whether conditions are changing in response to changes in management practices.

Over the past nine years, monitoring program personnel have collected data on hundreds of stream segments, lakes, and reservoirs across Wyoming with the purpose of determining whether the designated uses for each water body are fully supported. In many cases, data from the initial monitoring effort were not sufficient to make a determination on the level of designated use support. DEQ is committed to collecting the data necessary

to support conclusive determinations and have made it a high priority for the monitoring program in 2008. Many of the existing DEQ reference stations have been sampled only once, some of which were sampled as much as ten years ago. DEQ will continue to rotate through existing reference stations to determine if they still meet reference criteria and to collect another set of data on each stream. Having multiple data sets from each reference station will assist in gaining better understanding of conditions at these stations and to help understand how these stations vary in condition over time under relatively natural environmental conditions. This information will make DEQ better able to formulate more accurate and precise criteria for assessing biological condition of streams. In addition, the current reference station network has gaps in the spatial coverage of Wyoming. Specifically, more reference data are needed in the interior areas of the plains ecoregions. Filling these gaps will help facilitate better determinations of designated use support by helping to establish realistic goals for water quality and biological condition in these ecoregions.

Annual monitoring workplans list the specific streams, rivers, and reservoirs monitored during 2006 and 2007. These documents can be accessed at the following URLs:

<http://deq.state.wy.us/wqd/watershed/Downloads/Monitoring/2006workplan.pdf>

<http://deq.state.wy.us/wqd/watershed/Downloads/Monitoring/2007workplan.pdf>

## **Environmental Monitoring and Assessment Program**

EPA conducted the Environmental Monitoring and Assessment Program (EMAP) across the western United States, including Wyoming. The objectives of this project were to develop the monitoring tools (biological indicators, stream survey design, estimates of reference condition) necessary to produce unbiased estimates of the ecological condition of surface waters across large geographic areas of the west, and demonstrate those tools in a large scale assessment. Unbiased estimates require either a complete census of the ecological resource of interest (which is not practical) or a probability survey design that allows for extrapolation of monitoring results to the entire resource of interest. Such an approach will enhance the ability of the State to make unbiased statements about water quality and ecological condition at a much larger scale than is possible with the current design.

DEQ contracted the Wyoming District of the United States Geological Survey (USGS) to carry out this program in Wyoming and write a Scientific Investigations Report (Peterson et al. 2007). The complete report (Scientific Investigations Report 2007-5130) is available on the USGS website at <http://pubs.usgs.gov/sir/2007/5130/>. Estimates of aquatic life use support (ALUS) were made using several macroinvertebrate models, including the ALUS matrix based on results of the two quantitative tools DEQ uses to interpret macroinvertebrate data (Hargett et al. 2007; Hargett and Zumberge 2006; Hargett et al. 2005). Estimates of statewide ALUS based on this matrix are 52% achievement, 16% undetermined and 32% exceedence of narrative aquatic life use criteria. Because of the relatively small sample size (74 sample sites statewide), the 95% confidence interval for these estimates is  $\pm 10$ -15%. It should also be noted that these ALUS estimates were not made considering other data and information using a weight-of-evidence approach. The results of this report indicate the primary stressors impacting waters quality on a statewide scale are riparian disturbance and a lack of habitat complexity.

## **Statewide Water Quality Network**

DEQ and USGS participate in a joint-funding agreement that allows the USGS to conduct water quality sampling for two different projects in Wyoming. The first project funds ambient sampling at 25 locations across the state. Sampling is generally conducted four times per year on a quarterly basis. Sampled parameters vary from site to site depending on objectives, but include field parameters, major ions, trace metals, nutrients, sediment, and bacteria. Sampling locations are chosen for a variety of reasons, including monitoring of currently impaired streams, streams associated with WYPDES permits of concern, or trends in water quality of large river systems. The second project funds sampling at 44 sites, most of which are in NE Wyoming, although

a few are also in south central Wyoming. This project monitors water quality in areas affected by CBM development to determine if water quality changes are occurring as a result of current discharges, to establish baseline data in areas not yet developed or fully developed, and to determine compliance with existing water quality standards and permitting policies.

Sampling locations for these two projects can be found in Appendix B of DEQ's Water Quality Monitoring Annual Work plan: <http://deq.state.wy.us/wqd/watershed/Downloads/Monitoring/2007workplan.pdf>

## **Monitoring in Areas of Coal Bed Methane Development**

The Powder River Basin Interagency Working Group (PRB IWG) was established as the forum for government agencies to address and discuss issues of common concern to all parties involved in permitting and monitoring of CBM development. Additionally, attention will be given to those issues that may result in cross-border effects requiring close coordination among the State and Federal agencies in Montana and Wyoming, and with Tribal governments. Through this cooperative management effort, each agency will achieve greater operational efficiency, enhance resource protection and better serve the public. To address one of the components of the IWG mission, task groups were formed to address monitoring of natural resources potentially affected by CBM development (water quality and quantity, aquatic life, wildlife, and air). DEQ/WQD employees are members of the water quality and aquatic life monitoring task groups. Both the water quality and aquatic life task groups have developed monitoring plans for the affected areas of NE Wyoming. The water quality and aquatic life monitoring plans can be found at the following two links:

<http://www.wy.blm.gov/bfo/prbgroup/04minutes/surfacewatermonitoring06-16.pdf>

<http://www.wy.blm.gov/bfo/prbgroup/04minutes/aquaticbiotaplan06-16.pdf>

The USGS has been contracted to do most of the water quality and aquatic life monitoring in NE Wyoming. A USGS web site and Fact Sheet describing the aquatic life monitoring plan can be found at

<http://wy.water.usgs.gov/projects/atg/index.htm>. A Fact Sheet describing the water quality monitoring plan can be found at <http://pubs.water.usgs.gov/fs2005-3137>.

## **Probability Monitoring**

Section 305(b) of the CWA requires states to report on the condition of all waters of the State. Prior to 2004, Wyoming, like most states, had primarily monitored at targeted sites (mostly with suspected impairments) and therefore could only make scientifically defensible statements about the water quality condition of the waters at and near those sites. An estimate of statewide water quality conditions based on the targeted site data would be inherently biased. As a result, only a small percentage of the total waters of the State currently are reported as being assessed in the 305(b) report.

Currently, the only two approaches that will provide coverage of all waters of the State of Wyoming are: 1) a census of all waters, or 2) a probability survey. In the census approach every single water or stream segment within the state has to be visited and the condition measured. Obviously this is impossible. Probability surveys use a statistical approach (similar to opinion polls) to provide a cost-effective, scientifically-defensible alternative to periodically determine the condition of all waters. Using a subset of all waters, an estimate of the condition of all waters can be made along with a statement about the uncertainty surrounding the estimate. In a probability survey, a subset of waters is randomly selected (this ensures the "representativeness" or unbiased nature of the samples).

DEQ has decided that an absolute minimum of 60 sites must be selected through a probability survey and sampled before estimates of water quality conditions can be made on a statewide basis with any degree of

certainty. DEQ began implementing a probability survey in 2004. As of October 2007 DEQ has sampled 66 sites through use of a probability survey, and will select and sample a minimum of 15 to 20 sites per year using this approach for the foreseeable future.

## **Lake and Reservoir Monitoring**

Lake and reservoir monitoring was initiated in 1998. Initial protocols were developed and applied to all of the lakes and reservoirs that were on the 1996 303(d) list. Ten major reservoirs in the state are sampled on a rotation where approximately four are sampled in any given year. Each reservoir is sampled for three consecutive years, followed by three years without sampling. The effort on major reservoirs focuses on identifying trends in water quality over time using various chemical, physical and biological indicators.

## **Monitoring by Conservation Districts**

Since 1998, Wyoming's Conservation Districts, with the guidance and leadership of local watershed steering committees, have taken the initiative to improve water quality throughout the state. All of Wyoming's 34 Conservation Districts are involved in water quality activities at some level, including monitoring the waters within their districts, developing watershed plans to address identified impairments and threats, and assisting citizens to implement management practices to improve water quality (WACD, 2005).

Most watershed planning efforts are initiated in response to waters being listed on the 303(d) List of waters requiring TMDLs. Those waters being addressed by a local watershed planning effort are given a low priority for TMDL development, providing an opportunity for voluntary and incentive based implementation activities to improve water quality. The ultimate goal for watershed planning is to use local knowledge to determine actions needed to improve water quality and then implement them, in order to improve water quality and ultimately remove waters from the 303(d) list (WACD, 2005 and 2007).

Data and information was requested from all 34 of Wyoming's conservation districts for this report. Those districts which provided data that expanded the current knowledge of water quality in the state are mentioned under the "Summaries of Water Quality Conditions" section of this report. Further information on water quality monitoring and watershed planning by conservation districts can be found at <http://www.conservewy.com/>.

## **Discussion of "Habitat Degradation"**

Watershed assessment involves looking at the combination of chemical, physical, and biological conditions to determine stream "health." The endpoint for aquatic or stream health is the biological community, which is controlled by both chemical and physical processes. Most of the numeric criteria in Wyoming are based on chemistry, while most narrative criteria address physical and biological integrity. Chemical health is usually fairly easy to understand. Too much (or in some cases, such as dissolved oxygen, too little) of a substance dissolved in the water can have deleterious effects on the biological community. Therefore, a healthy biological community thrives best in water with certain chemical characteristics. But how do physical attributes affect the stream and its biological community?

As healthy streams flow through different types of terrain, they exhibit certain characteristics which can generally be predicted based on climate, flow regimes, substrate, valley shape, gradient, and other landscape features. Perhaps the most important attribute common to healthy streams in any environment is stream stability. Although streams are always changing somewhat, a healthy stream is relatively stable from one year

to the next, in all flow regimes, from floods to low flows or even no flows (BLM, 1998). Stable streams have the ability to transport sediment loads under bankfull (high flow) conditions without significant erosion or instream sediment deposition (Leopold and Maddock, 1953). Because of this stability, aquatic organisms can establish themselves without being eradicated by severe scouring from floods and/or without being smothered by excessive sediment deposition. A stable stream also has a variety of habitats and physical features which provide living space for more age groups and a greater diversity of fish and other aquatic organisms. From a water quality standpoint, a healthy stream will trap and remove sediment and nutrients in the flood plain and riparian area during high flows, which improves instream water quality for aquatic life, while benefiting riparian plants, which in turn benefit livestock and wildlife.

Not only does a stream in good physical condition benefit aquatic life, but it also reduces flood damage to adjacent property, and provides better sub-irrigation and production in valuable bottom lands. Because of the moisture holding capability of a healthy riparian system, peak flows are reduced and stream flow continues longer in the season, which is good for both aquatic life as well as users of the stream water.

Because these processes and effects are so interlinked, a physically degraded stream will nearly always exhibit more than one physical problem. For example, a stream with severely eroding banks will also usually be wider and shallower than a stream in good condition. Depending on the flow regime, it will also probably have areas of excessive instream sediment deposition as well as areas of high sediment transport, both of which do not allow many stable areas for aquatic life and less variety of aquatic habitats. These physical and habitat problems are often compounded because the stream can be more prone to developing anchor ice in the winter and can also have higher summer temperatures. Obviously the end result is a reduction in biological community integrity.

When DEQ conducts stream assessments, chemical, physical, and biological conditions are examined and compared with the ranges of conditions expected, based on a suite of reference streams with similar geology, flow regimes, substrate, valley shape, gradient, and other landscape features. If, using a weight-of-evidence approach, a stream without measured chemical problems has substantially degraded physical and habitat features, with a resulting degraded biological community, it is considered impaired for aquatic life due to physical degradation of the aquatic habitat. For the purposes of 305(b) reporting and the 303(d) listing process, the combination of those degraded physical and habitat conditions is summed up in the broad term “Habitat Degradation.”

Although habitat degradation is not a pollutant, EPA feels that most habitat degradation seen in western streams is due to unbalanced sediment loading, and sediment is the **pollutant**. Therefore, those waters impaired or threatened by habitat degradation need to be listed on the 303(d) list, and not placed in Category 4C. Habitat degradation caused only by low flows (legal water withdraws) or historic channelization and flood control is considered **pollution** and those waters are not placed on the 303(d) List. Three waters with habitat degradation impacts due solely to low flows or flow alteration are discussed in the 2008 305(b) Report.

### ***E. coli* as an Indicator of Fecal Contamination**

In previous water quality standards, counts of fecal coliform served as the indicator of the relative amount of fecal contamination in water. However, counts of *E. coli*, one of the bacteria that make the fecal coliform group, have been found to better indicate risk of illness to people exposed to contaminated water. EPA has recommended that states use criteria based on *E. coli*, rather than fecal coliform, in their standards for contact recreation uses. With the revision of Chapter 1 in 2007, the criteria for assessment of recreation uses in

Wyoming transitioned from fecal coliform to *E. coli*. Although many strains of *E. coli* are pathogenic in themselves, the criteria are in place to protect people from other fecal based pathogens, whether bacterial, viral or protozoan. Because bacterial populations are highly variable, the *E. coli* criteria are based on a 30-day geometric mean of not less than 5 samples obtained during separate 24 hour periods. The intent of the 30-day geometric mean is to average temporally distributed samples so as to be representative of the entire 30-day period.

Wyoming waters are designated as either primary or secondary contact recreation waters. All waters in Table A of the Wyoming Surface Water Classification List are designated for primary contact recreation unless identified as a secondary contact water by a “(s)” notation. Waters not specifically listed in Table A of the Wyoming Surface Water Classification List are designated as secondary contact waters. The following *E. coli* criteria apply:

**Table 1. *E. coli* Criteria for Protection of Recreation Water Use**

<b>Recreational Use Designation</b>	<b>Season</b>	<b><i>E. Coli</i> Criteria</b>
Primary Contact	May 1 - September 30	Concentrations of <i>E. coli</i> bacteria shall not exceed a geometric mean of 126 organisms per 100 milliliters based on a minimum of not less than 5 samples obtained during separate 24 hour periods for any 30-day period.
Primary Contact	October 1 - April 30	Concentrations of <i>E. coli</i> bacteria shall not exceed a geometric mean of 630 organisms per 100 milliliters based on a minimum of not less than 5 samples obtained during separate 24 hour periods for any 30-day period.
Secondary Contact	All Year	Concentrations of <i>E. coli</i> bacteria shall not exceed a geometric mean of 630 organisms per 100 milliliters based on a minimum of not less than 5 samples obtained during separate 24 hour periods for any 30-day period.

Before an assessment is conducted for contact recreation, a Use Attainability Analysis (UAA) will be conducted to determine whether the water should be designated for primary or secondary contact recreation. This procedure is outlined in the Wyoming Water Quality Standards Implementation Policies.

Waters listed on previous 303(d) lists due to exceedences of previous fecal coliform criteria will remain listed even though those criteria no longer apply. Most of these listed waters have both *E. coli* and fecal coliform data, and exceedences of one or both of the respective criteria. Therefore the discussion in this report will generically refer to that mixed data set as fecal bacteria data. However, in order for those waters to be delisted, *E. coli* data will need to show no exceedences of the criterion for a three year period.

## Mercury in Fish

The bioavailable form of mercury is methyl mercury. Therefore essentially all the mercury which accumulates in fish tissue is in the form of methyl mercury. EPA recommends using a fish tissue criterion for methyl mercury rather than a water quality criterion because it is a more direct measure of bioaccumulation, it is based on the dominant human exposure route, and it is less variable over time (USEPA, 2001). However, Wyoming does not currently have a numeric methyl mercury criterion for fish tissue. Fish tissue criteria for bioaccumulating substances are based on average daily consumption. Wyoming’s water column numeric criteria for fish consumption are based on an average consumption of 6.5 grams fish/day. Extrapolating this quantity of fish consumption would give a fish tissue “criterion” of 1.0 mg methyl mercury/kg fish (1.0 ppb) (USEPA, 2001). Wyoming fish generally have among the lowest fish tissue concentrations of methyl mercury

in the country. This concentration (1.0 ppb) has only been exceeded in a few of the largest predatory fish sampled in three reservoirs by WGFD: one 24 inch channel catfish in Big Horn Lake; one 28 inch walleye in Pathfinder Reservoir, and; two 30 inch walleyes in Seminoe Reservoir. Because the vast majority of game fish in these reservoirs have methyl mercury concentrations below 1.0 ppb, these reservoirs will not be listed on the 303(d) List for methyl mercury.

However the Wyoming Department of Health has issued a fish consumption advisory for fish with “high” concentrations of methyl mercury, which is considered to be 0.5 mg methyl mercury/kg fish. Women of childbearing age, pregnant women, nursing mothers and children under 15 are advised not to eat channel catfish, sauger, and walleye from Big Horn Lake, and Seminoe and Pathfinder reservoirs. Other people should eat no more than one to two meals per month of these fish.

<http://www.health.wyo.gov/news.aspx?NewsID=134>. Because methyl mercury concentrations tend to be highest in older, generally larger fish, it is also recommended that smaller fish be consumed rather than larger fish.

## Coal Bed Methane Development

The structural unit of the Powder River Basin in northeastern Wyoming, consisting of the hydrologic units of the Upper Cheyenne River, Upper Belle Fourche River, and most of the Little Powder River, Powder River, and Tongue River continues to experience increased Coal Bed Methane (CBM) activity. Ninety-eight percent (approx. 17,500) of active CBM wells in Wyoming are drilled in the greater Powder River structural unit. The remaining 2% (approx. 300) occur in south central Wyoming in the Little Snake, Green River and Great Divide Basins.

To produce the gas, operators must partially de-water the coal seam. Most of the produced water in the Powder River development area is discharged to the surface under a variety of water management techniques including direct discharge, treatment and various reservoir containment options. In the south central part of the state produced water is generally of poorer quality and is primarily re-injected.

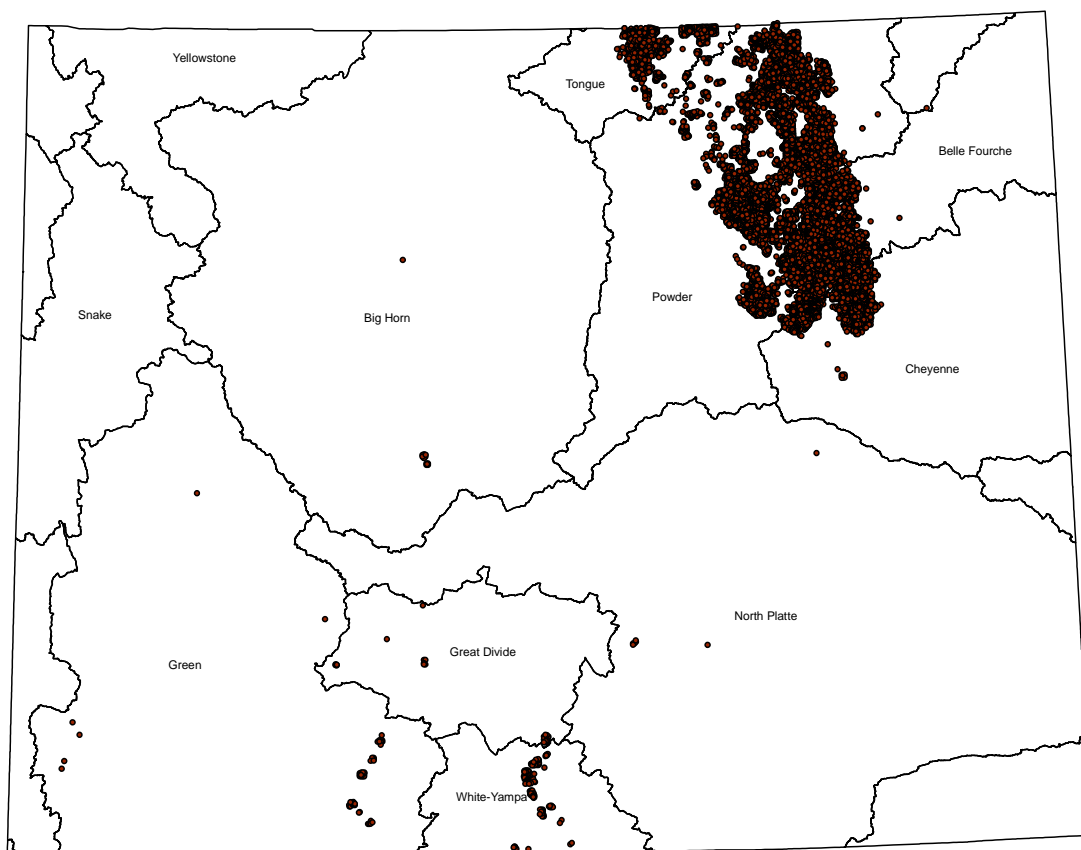
The main pollutants of concern associated with the CBM produced water are salinity and sodium because of their potential to adversely affect irrigated lands and bottomland productivity. To a lesser extent barium, iron and fluoride can be a problem in some areas. Generally, produced water quality is best in the Belle Fourche, Cheyenne and eastern Powder River drainages and tends to become more saline and sodic west of the Powder River and in the Tongue River drainage.

Because of the density of CBM development in the Powder and Tongue drainages an effort is being made to regulate discharges on a watershed basis. The watershed based permitting approach considers the cumulative impacts of CBM discharges within a specific watershed and involves a stakeholder process that assists with the development of each watershed permit or plan. Watershed permits have been developed in the Pumpkin Creek and Willow Creek watersheds and a watershed plan has been adopted for use in the Fourmile Creek watershed. Work has been ongoing, though not yet complete in Clear Creek, Fence Creek, Crazy Woman Creek, Dead Horse Creek and the lower Tongue River Watersheds. It is anticipated that it will take several years to implement watershed based permitting for all the watersheds in the Powder River Basin. More information on watershed based permitting can be found at [http://deq.state.wy.us/wqd/CBM\\_watershed\\_permitting.asp](http://deq.state.wy.us/wqd/CBM_watershed_permitting.asp).

An assimilative capacity program has been established to control the loads of total dissolved solids (TDS) and sodium that may reach the main stem of the Powder River measured in Moorhead, Montana. The total allowable loads for TDS and sodium are calculated to ensure compliance with Montana standards for conductivity and sodium adsorption ratio (SAR) at the state line. Monthly percentages of the total loads are allocated to gas developers based upon the percentage of Powder River coal that they have leased. A similar program has not been developed for Tongue River watershed discharges where all produced water is currently contained in reservoirs or treated to background quality before discharge.

Wyoming, Montana and South Dakota continue to cooperate in the development of CBM activities and to monitor the effects of these activities within the affected drainages. The cooperation between the state agencies provides assurance that Montana and South Dakota's downstream water uses will be protected while coal bed methane develops in the upper reaches of the drainages. The cooperative effort recognizes that Wyoming can proceed with permitting additional CBM operations, but will do so in a cautious manner to protect downstream users of the affected drainages. The effort includes a comprehensive monitoring network, collection of real time monitoring data at the border, and periodic analysis of trends. It sets reaction levels, based primarily on salinity and SAR, should unexplained changes be observed in the recorded history of the system. If reaction levels are reached at the border, the comprehensive monitoring network is used to reassess the system to determine if the upsets may be associated with CBM operations or some other source or anomaly. This comprehensive watershed monitoring and analysis program also helps the states develop a better understanding of the Powder River system and how it responds to the new CBM activity.

**Figure 1. Distribution of CBM wells**



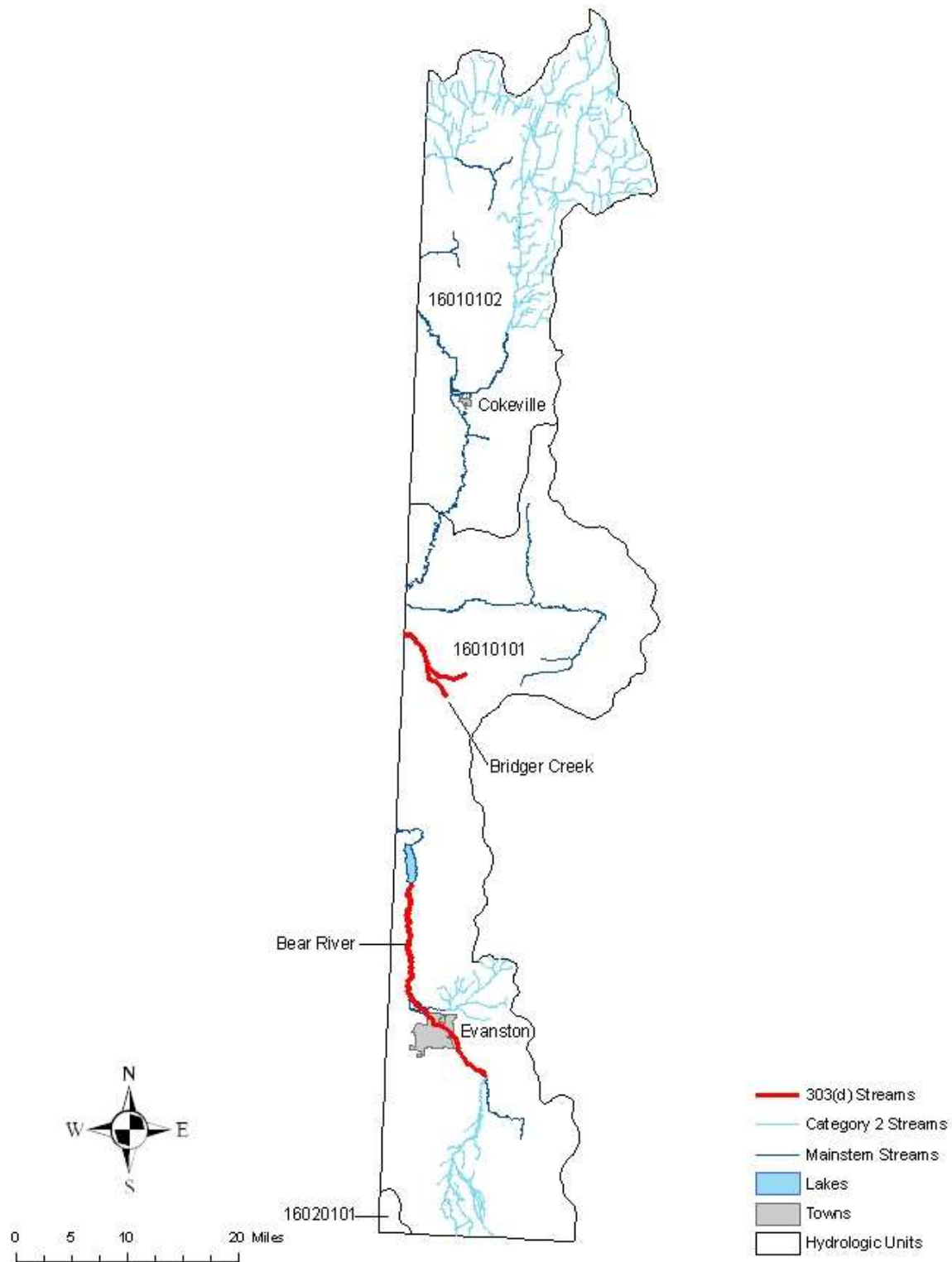
## **River Basin Descriptions and Summaries of Water Quality Conditions**

The following sections describe the major river basins in Wyoming and summarize water quality conditions in each basin. Each basin section is preceded with a map that shows the major water and eight digit Hydrologic Units (HUCs), and highlights the approximate location of the impaired and threatened waters on the 2008 303(d) List. Each basin section is then subdivided into HUCs, referred to as sub-basins in this report. Water quality conditions, based on existing data and information, are discussed in each of these sub-basin sections.

Please note that only “credible data”, as defined by Wyoming Law, and which was objectively collected and is spatially and temporally representative of actual water quality have been used to make designated use support decisions. However, in much of this report, probable water quality conditions or concerns may be described, based on valid data and information, because DEQ has a responsibility to the public to describe what is known about water quality in Wyoming. We have attempted to clearly distinguish between the designated use decisions and probable water quality conditions in this report. Both use attainment and water quality conditions can change over time and this report was written based on the best available knowledge at this time. Any third party knowing of available data or information which can be used to better describe water quality conditions should please notify the WQD 305(b) Coordinator, Richard Thorp, in writing at DEQ-WQD, 122 West 25<sup>th</sup> Street, Herschler Building 4-W, Cheyenne, WY 82002, fax (307) 777-5973 or email to [rthorp@wyo.gov](mailto:rthorp@wyo.gov).

Also, please note that the maps and highlighted 303(d) waters are not necessarily drawn to scale, and the beginning and end points of the water quality limited reaches may not be accurate. The highlighted reaches are only shown to give an approximate location within a river basin. Please refer to the location description in the 303(d) List to determine the extent of the reach, as well as existing data allows. Additionally, because streams are dynamic entities, and because the extent of water quality limitations varies over time, the exact location of water quality limitations often can only be approximated. As further sampling is conducted, the extent of water quality limitations can be better described. Any knowledge of available data which can be used to better delineate these stream reaches would be appreciated by WQD.

## Bear River Basin 2008



## Bear River Basin

The Bear River originates in the Uinta Mountains of Utah and flows north into Wyoming. Downstream (north) of the City of Evanston the river is dammed at Woodruff Narrows, flows back into Utah, then re-enters Wyoming near Sage Junction. The Bear River flows toward the north through the Town of Cokeville and then crosses into Idaho, near the community of Border. Water from the Bear River is diverted into Bear Lake (in Idaho and Utah) to increase storage capacity. Eventually the Bear River reaches the Great Salt Lake in Utah, making it the largest river in the western hemisphere without an ocean outlet.

Below Woodruff Narrows Reservoir the valley widens and water is extensively diverted and utilized for irrigation of alfalfa, pasture land and small grains. Bear River Basin streams are mostly perennial at higher elevations, but at lower elevations, stream flow in smaller streams is often intermittent or ephemeral. The basin contains many large reservoirs and hundreds of small stock ponds and reservoirs as well as extensive networks of irrigation canals.

The Bear River is apportioned among Idaho, Utah and Wyoming, under the interstate compact agreement of 1958 and amended in 1978. Many streams which were reportedly perennial in the past now do not flow during some months (ERI, 1992; NRCS, 2001; USGS, 2004). This may be due in part to irrigation diversions, but channel down cutting, loss of riparian vegetation and damming of drainages are also possible causes. Many studies associated with the Bear River and its tributaries in Wyoming and Bear Lake in Utah have been completed and published. The state DEQs in Idaho, Utah, and Wyoming are currently sponsoring a basin-wide coordinated surface water monitoring program on the Bear River. A total of 13 monitoring locations have been established along the length of the Bear River with quarterly monitoring (low elevation runoff, high elevation runoff, summer irrigation season, and fall base flow) occurring in order to have a more holistic water quality data set. This effort is on-going and no final report has been issued to date.

In the Bear River Basin in Wyoming, much of the geology consists of fine-grained sedimentary formations which have been thrust faulted into steep, geologically young mountains which are easily eroded. As a result, surface waters have a high natural load of fine sediment, and often salts, carbonates, sulfates, and/or phosphate, which are found in the parent geologic material. Streams in much of the basin are highly dependent on vegetation for physical stabilization and are usually very sensitive to disturbance.

Two of the major water quality concerns in this basin are centered on the Bonneville (Bear River) cutthroat trout and the water quality of Bear Lake in Idaho and Utah. Historically, Bonneville cutthroat trout were found throughout the Bear River and other Great Basin watersheds, but competition from non-native species, loss of aquatic habitat, and water quality changes have impacted the populations of these fish. The Bonneville cutthroat trout was petitioned for listing under the Endangered Species Act as a threatened species throughout its range in 1998. In 2001, the U.S. Fish and Wildlife Service (USFWS) determined that listing was not warranted, however that decision is currently under review by the USFWS. It is the view of the Wyoming Game and Fish Department (WGFD) and of DEQ that a listing is not warranted in Wyoming, and that the best and most economical ways to protect this species are through education, protecting and rehabilitating stream habitat, and reducing competition from unwanted introduced species. WGFD has been working with the states of Idaho, Nevada and Utah as part of a Bonneville Cutthroat Interagency team developing conservation strategies and agreements to improve and help sustain Bonneville cutthroat trout populations.

Naturally high levels of calcium carbonate and historically crystal clear water in Bear Lake give it a very blue color. However, studies have shown that nutrient enrichment, and subsequent algal growth, has decreased the clarity of the water. In order to increase the range of Bear River cutthroat trout and improve the water quality in Bear Lake, numerous water quality studies and improvement projects have been conducted in the watershed,

including in Wyoming. Both Idaho and Utah have written TMDLs for the Bear River.

### **The Upper Bear River Sub-basin (HUC 16010101)**

In Wyoming this sub-basin includes those areas from the Twin Creek drainage upstream. Primary land uses are grazing in the uplands, irrigated hay and small grain production along valley bottoms, oil and gas production (including gas processing), and areas of historic phosphate and coal mining.

Water quality assessments conducted by DEQ on the Bear River in 1995, 1996, and 1998 indicate it is supporting its designated use as a cold water fishery above Sulphur Creek. DEQ also conducted monitoring on the Bear River below Sulphur Creek in 1998. Analysis of those data indicates that the Bear River between Sulphur Creek and Woodruff Narrows Reservoir is only partially supporting its aquatic life uses due to instream sediment deposition. Additionally, much of this reach is channelized, which has resulted in a significant loss of trout habitat. This reach was added to the 303(d) List in 2002. Uinta County Conservation District has formed a watershed steering committee and has an approved watershed plan for the Bear River. The Bear River in and near Evanston is the site of a cooperative WGFD Riparian improvement project.

Assessments were also conducted by DEQ in 1998 and 1999 on Sulphur Creek, both above and below Sulphur Creek Reservoir. The data and information gathered as part of the assessment effort identified several stressors, including bank erosion, rapidly fluctuating flows below the reservoir, heavy riparian grazing, and seasonal low flows in the upper stream channel. The assessments confirm that Sulphur Creek is properly classified as a cold water fishery (Class 2AB), however, the data were insufficient to determine whether the physical and biotic condition was due to anthropogenic or natural stressors. Both segments were monitored again in 2003.

Oil has been produced in the Yellow Creek/Thief Creek drainage since the early 1900s and continues today. More recently, natural gas has been produced and processed, and grazing occurs throughout the drainage. Only the upper part of Thief Creek and some reaches of Yellow Creek are perennial. Soils in this drainage are highly susceptible to erosion and contain naturally high levels of calcium, magnesium, chloride, and sulfate. Streams are reported to be incised in these highly erodible and unstable geologic materials (ARE, 1983; ERI, 1985). The relative influence of natural and man caused activities cannot be determined at this time.

DEQ assessment of Pleasant Valley Creek above Crompton Reservoir indicates full support of designated Class 3B aquatic life uses in the watershed. The assessment also notes the presence of non-game fish, indicating Pleasant Valley Creek would be more properly classified as 2C.

Streams in the Twin Creek drainage lie in highly erodible shales which contribute carbonates, salts, and metals to the streams. Rock Creek and many of its tributaries are perennial, but Twin Creek itself is non-perennial above the Rock Creek tributary confluence. In the upper Twin Creek drainage, the only perennial tributary reach is in Clear Creek below a spring. Loss of perennial flows in upper Twin Creek since the 1970s is a reported resource concern (NRCS, 2001). Both the road and the railroad line, built along the Twin Creek main stem in the late 1800's, have encroached on the stream channel. Phosphate was mined in the drainage between 1910 and 1977. In addition, a phosphate mill (crushing, pulverizing and bagging) operated until about 1985, with ore imported from Idaho. An unstable tailings pile and many eroding spoils piles are associated with the mining area. AML completed reclamation on 140 acres in 2002-2003, and the final 225 acres are expected to be reclaimed by 2008. DEQ has conducted monitoring in the Twin Creek drainage and initial data review indicates concerns with bank erosion and sediment loading. Additional data were collected in 2004.

Studies in the 1980s and early 1990s identified the Bridger Creek drainage as a significant contributor of both sediment and phosphates into the Bear River (ERI, 1992). In 1996, a 319 watershed improvement project was completed in Wyoming and Utah, which significantly reduced this loading to the river. In Wyoming, seven small detention reservoirs were rebuilt to reduce head cutting and a large gravel pit was incorporated into a

sedimentation basin at the border. Additionally, grazing practices in the watershed were modified to improve riparian cover and vigor to stabilize stream banks. According to the BLM, these practices have also increased stream flows. Bridger Creek is identified as threatened on the 303(d) List due to threats to aquatic life use support within the drainage. Recent monitoring suggests that the changes in grazing management should address the threats. However, it will take time for riparian conditions to dramatically improve to stabilize stream banks, given the dry climate and flashy flows in the watershed.

### **Central Bear River Sub-basin (HUC 16010102)**

This sub-basin contains those drainages in Wyoming below Twin Creek, including the Smiths Fork and upper Salt Creek/Thomas Fork drainages. Land uses include historic phosphate mining, grazing, irrigated agriculture, wildlife habitat, and a number of recreational activities on the Bridger-Teton National Forest and BLM lands. Irrigated agriculture occurs at lower elevations, primarily along the main river and creek drainages throughout the sub-basin. Cokeville Meadows National Wildlife Refuge consists of wetland and upland areas along the Bear River immediately south of Cokeville. The refuge was established in 1993 with approximately 8,100 acres of the potential 26,657-acre acquisition area currently being protected through purchase or conservation easement.

Primary land use along the main stem Smiths Fork is irrigated pasture and hayland, with year-round recreation, seasonal grazing, and some logging in the upper drainage. Channel straightening and willow removal, intended to increase productive acreage during the mid 1900s, are reported to have caused accelerated bank erosion and stream widening along much of the lower Smiths Fork. Steps are being taken to mitigate these impacts in places. A Smiths Fork Steering Committee has been formed to improve water quality, bank stability, and wildlife habitat by modifying grazing practices and controlled burns. Considerable acreage along the Smiths Fork has been incorporated into the National Resource Conservation Service's (NRCS) Conservation Reserve Program (CRP) riparian forest buffer program.

The Smithfork Allotment is a 90,937-acre cattle and sheep allotment located north and east of Cokeville, Wyoming. A major management concern on this allotment is the condition of riparian areas associated with streams and upland springs and seeps due to past grazing and other activities, which include chemical spraying of the riparian areas subsequently killing most of the willow populations in the late 60's and early 70's, and numerous sheep to cattle conversions. Under season-long grazing use, and with a lack of upland water sources, livestock tend to concentrate in riparian areas for virtually the entire growing season every year. Proper Functioning Condition Inventory Data collected by the BLM indicates that most of the streams are "functioning at risk" which means the riparian-wetland areas are in functional condition, but some resource attribute makes them susceptible to degradation. Some are in an upward trend and some are in a downward trend. The BLM released the Smithfork Allotment Management Plan in March 2005 that will provide grazing management practices that should improve riparian vegetation on stream corridors and upland spring sites which should then result in improved water quality for the Smiths and Thomas Fork Watersheds (BLM, 2005).

Water quality assessments conducted by DEQ on Coantag and Hobble Creeks, and in the Smiths Fork drainage above North Smiths Fork indicate they are fully supporting their aquatic life uses.

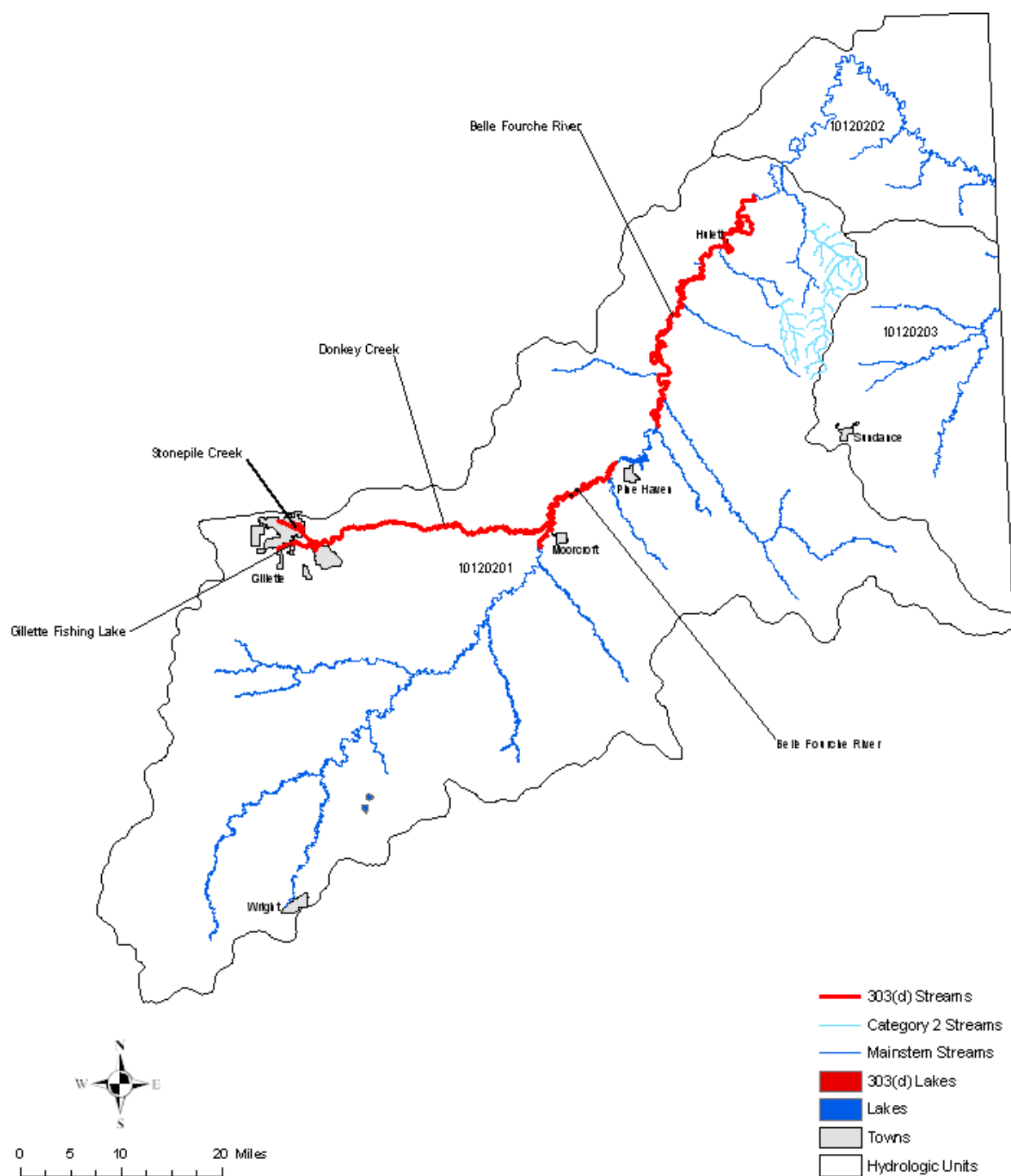
Extremely low flows in the Bear River during the past several years of drought, apparently have contributed to elevated water temperatures near Cokeville.

Land ownership in the Salt Creek drainage, which flows into Idaho where it is called the Thomas Fork, is primarily public with scattered small private holdings. Public lands are managed for multiple use, including recreation and grazing. Sediment and nutrients have been identified as possible water quality concerns in parts of this drainage, both in Idaho and Wyoming (ERI, 1992). Salt Creek has places with some unstable banks; much of which stems from the stream adjusting to the physical restrictions due to construction of the highway

within the valley and from slumps and landslides in the unstable geology which have encroached on the stream. Results of monitoring conducted by DEQ on Salt Creek indicate stabilizing riparian conditions, and a fairly healthy macroinvertebrate community; however it is unclear whether the stream will support its cold water fisheries use during the summer months. WGFD and the BLM have completed a number of riparian improvement projects in the Coal and Little Muddy Creek sub-watersheds for the enhancement of Bonneville cutthroat trout populations.

Giraffe Creek is a tributary to Salt Creek which originates in Idaho, then flows into Wyoming for a few miles before it joins with Salt Creek. DEQ assessment of Giraffe Creek indicates it is fully supporting its aquatic life uses in Wyoming.

# **Belle Fourche River Basin** **2008**



## **Belle Fourche River Basin**

The Belle Fourche River headwaters are in the plains south of Gillette. The river flows north-east, around the Bearlodge Mountains, then swings to the south-east and enters South Dakota. There are two distinct topographic regions: the rolling plains of the Powder River geologic basin in the west, and the Black Hills uplift in the east. Most streams originating in the plains are naturally intermittent, but discharges from coal mines, coal bed methane production, and the City of Gillette provide perennial flow in Donkey Creek, a portion of the Belle Fourche River and several other plains streams.

Keyhole Reservoir is located on the Belle Fourche River about 17 miles northeast of Moorcroft, Wyoming. The reservoir is owned and operated by the Bureau of Reclamation. Keyhole was initially built in the 1950s to provide a supplemental water supply to the Belle Fourche Reservoir in South Dakota and for flood control. The reservoir was completed in 1952. It has a conservation capacity of 193,753 acre-feet. The inflows and storage in the reservoir are allocated 10% to Wyoming users and 90% to South Dakota users subject to prior rights (Hoyer and Larson, 2005).

Below Keyhole Reservoir, the Belle Fourche River has perennial flow due to reservoir releases as well as influences of perennial streams originating in the Black Hills. The Belle Fourche River Compact of 1943 regulates water rights in the Belle Fourche River Basin. Primary land uses in the basin are livestock grazing, hay production, and mineral extraction, including bentonite and coal mining, and oil, gas, and coal bed methane development.

The South Dakota Department of Environment and Natural Resources' (DENR) 2006 Integrated Report (DENR, 2006) has the Belle Fourche River on their Section 303(d) list of impaired waters from the Wyoming/South Dakota state line downstream to Fruitdale, South Dakota for two pollutants. DENR reports the immersion recreation designated use is not fully supported due to fecal bacteria and also the warmwater permanent fish life designated use is not fully supported due to total suspended solids (TSS).

DENR completed a TSS TMDL for the Belle Fourche River in early 2005 (Hoyer and Larson, 2005). Two of the conclusions from that document potentially have implications within the State of Wyoming. First, the TMDL concluded the most significant source of sediment in the river is expected from stream entrenchment and bank failure. Second, the TMDL concluded that the release of water from Keyhole Reservoir for irrigation purposes, as well as startup of the Belle Fourche Irrigation District (BFID), have significant impacts on TSS and specific conductivity in South Dakota.

DENR presently has distributed a fecal coliform TMDL for the reach of the Belle Fourche River immediately downstream of the Wyoming/South Dakota state line (Foreman, 2007). The TMDL reports a 46% reduction in fecal coliform bacteria is necessary to bring the river into compliance with South Dakota state water quality standards. The report's summary states that based on samples collected on the project, it appears that natural background from wildlife is the largest contributor of fecal coliform bacteria in the Belle Fourche River in South Dakota. Bacteria source tracking was performed on samples collected on three different dates, and no evidence was found of fecal coliform from human or cattle sources. However, the reports states the small sample size does not allow for a totally defensible conclusion. The TMDL document recommends acceptable riparian grazing BMP implementation, such as filter strips, to reduce fecal contamination entering the river via overland flow, regardless of the source. The document also recommends additional bacteria source tracking to further refine the BMP implementation process.

## **Upper Belle Fourche Sub-basin (HUC 10120201)**

The Upper Belle Fourche Sub-basin includes the drainages from Beaver Creek, north of Alva, upstream. Livestock grazing and hay production are the primary agricultural land uses. Coal mining and coal bed methane development are important land uses in the western portion of the sub-basin, and logging, wildlife habitat, and recreation are other important land uses in the Black Hills.

Two reaches of the Belle Fourche River are listed on the 303(d) List due to exceedences of the criteria for fecal bacteria, indicating the contact recreation use is not supported. Monitoring by DEQ identified the extent of those reaches as from Keyhole Reservoir to an undetermined point above Rush Creek, and between Hulett and Arch Creek. The extent of the impairment downstream of the Town of Hulett is unknown. Crook County Conservation District has conducted further monitoring, implemented septic and animal feeding operation projects, and has developed a watershed plan. For more information, see <http://www.ccnrd.org/>.

Previous analysis of data collected by DEQ suggested that the Belle Fourche River, from Keyhole Reservoir up to Raven Creek, appeared to support its aquatic life and warm water fishery uses. However, that assessment noted three exceedences of the chloride criterion between 1975 and 1990 and recommended future monitoring of chloride. Monitoring by the USGS as part of the CBM water quality network, indicates the chloride criterion is now frequently exceeded in the Belle Fourche River below Donkey Creek. Additionally, ammonia data show occasional exceedences of acute criteria for ammonia. Therefore ammonia and chloride have been added as pollutants on the 303(d) List for the Belle Fourche River from Keyhole Reservoir up to an undetermined distance above Donkey Creek.

Gillette is the fourth largest community in Wyoming and lies at the upper end of the Donkey Creek drainage. Results of monitoring conducted by DEQ and Campbell CCD over several years indicate that Donkey Creek, from the Belle Fourche River upstream to an undetermined distance above Antelope Butte Creek, is impaired for human contact recreation due to exceedences of fecal bacteria criteria. Consequently Donkey Creek is on the 303(d) List. Stonepile Creek, a tributary to Donkey Creek, is also on the 303(d) List for not supporting its contact recreation uses. A watershed plan and implementation to address these fecal problems is focusing on septic system rehabilitation.

Development of TMDLs for all listed pollutants on the Belle Fourche River, Donkey Creek and Stonepile Creek are expected to begin in 2009 with a completion date of 2010.

Assessment of Gillette Fishing Lake, conducted by Campbell CCD under a 205j grant, indicated impairments due to high amounts of sediment and phosphate coming from stormwater runoff. Gillette Fishing Lake is listed on the 303(d) List. Campbell CCD, in cooperation with the city, has developed a watershed plan to address the impairments on Gillette Fishing Lake (WACD, 2005). The City of Gillette has installed stormceptors and will be constructing a wetland to trap sediment and phosphorus from runoff before it reaches the lake. There are additional plans by the City to dredge Gillette Fishing Lake to remove sediment, as well as plans to install bank stabilization (WACD, 2002). A TMDL for these pollutants is expected to be finalized by 2009.

Monitoring conducted in the Black Hills by DEQ show full support of designated 2AB aquatic life uses in Blacktail Creek within Black Hills National Forest. Elevated water temperatures in Beaver Creek appear to be due primarily to historic channel widening caused by a combination of past grazing practices and changes in flow regime from Cook Lake. The system has since stabilized, and DEQ monitoring indicates Beaver Creek is fully supportive of its designated class 2AB aquatic life uses. DEQ monitoring in this watershed also shows full aquatic life use support in several tributaries: Wood Canyon, Reservoir Gulch, Fawn Creek and Little Creek (3B), and in Cub Creek (2AB). A reach of Whitelaw Creek has been monitored by DEQ as a long term reference site since 1993. Extrapolation of those data and assessments to the remaining tributaries, indicate full

aquatic life use support in the Beaver Creek watershed.

#### **Lower Belle Fourche Sub-basin (HUC 10120202)**

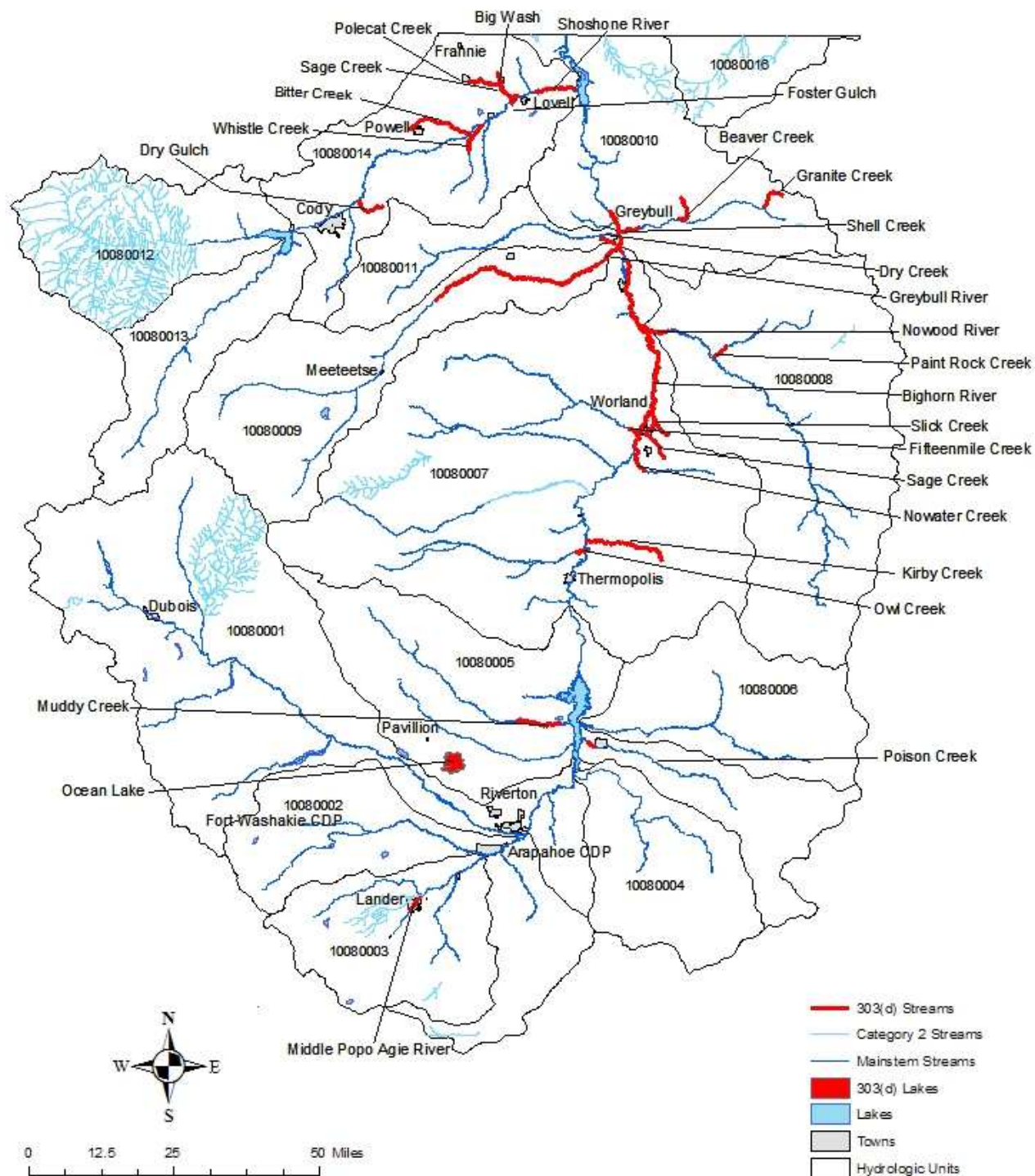
The Lower Belle Fourche Sub-basin includes the drainages entering the Belle Fourche River below Beaver Creek and above Redwater Creek. Logging, grazing, irrigated hay, small grain production, recreation, wildlife habitat, and bentonite mining are the primary land uses. Conflicting data and different state water quality standards do not enable a determination on whether the contact recreation impairment seen in the Upper Belle Fourche Sub-basin continues downstream into this sub-basin. Bacteria data collected by Crook County Natural Resource District in 2003 and 2004 (EDE, 2005) show individual *E. coli* samples in this sub-basin as high as 2,419 CFU/100 mL, however the corresponding 30-day geometric means, based on a minimum of 5 individual samples, were all less than the state's 126 CFU/100 mL criterion. The SD DENR TMDL document reports 9 of 16 individual samples collected in 2004 and 2005 exceeding that state's 400 colony forming units per 100 mL single sample maximum criterion for fecal coliform bacteria (Foreman, 2007). However, it does not appear there were sufficient samples collected to determine a 30-day geometric mean based on a minimum of 5 individual sample events.

#### **Redwater Sub-basin (HUC 10120203)**

The Redwater Sub-basin drains the eastern slope of the Bear Lodge Mountains before it joins the Belle Fourche in South Dakota. Logging, recreation, wildlife habitat, hay and livestock production are the primary land uses.

Sand Creek is protected as a Class 1 water. At Ranch A, springs discharge thousands of gallons of water per minute, and the stream below is considered a high quality trout fishery. DEQ has conducted monitoring on Sand Creek. Although a final report is not complete, the reach of Sand Creek extending a few miles below the springs appears to be supporting its aquatic life and fisheries uses.

# Big Horn Basin 2008



## **Bighorn River Basin**

The Bighorn River Basin takes up a large portion of north-central Wyoming. For this report, the Bighorn River Basin includes the Wind River and all the other drainages into the Bighorn River in Wyoming, as well as the Little Bighorn River Sub-basin. The basin is bounded by the Absaroka Range on the west, the Wind River Mountains, Beaver Rim and Bridger Mountains on the southwest, south and southeast respectively, and the Bighorn Mountains on the east. As with any river basin, water quality is strongly influenced by geology and terrain. Natural water quality characteristics of streams coming off the Wind River Range and Bighorn Mountains are fairly similar due to relatively similar terrain, geology and climate. Water quality is generally good in these mountain ranges, but water quality gradually changes as streams flow across the basin to the Bighorn River due to natural erosion and stream processes increasing sediment and total dissolved solid (TDS) loads. Accelerated erosion, irrigated agriculture runoff, discharge from oil and gas development and other dischargers, and other human activities have the potential to degrade the water quality further (USGS, 1956; USGS, 1999).

Streams draining the Absaroka Range naturally carry very high sediment loads due to the easily eroded volcanic geology and steep slopes associated with relatively young mountains. Most of the lower portions of the Bighorn Basin have thin soils derived from highly erodible, saline, alkaline and/or phosphate-rich geologic materials. Additionally, much of the precipitation in the lower elevation portions of the basin (which typically receive less than 9 inches per year) emanates from thunderstorms, which tend to cause flash flooding and severe erosion of sparsely-vegetated, normally dry soils. Therefore, the Bighorn River naturally carries high sediment loads, but it is thought that human influences have increased the sediment loads. Man's influence on sediment transport in some of the lower elevation portions of the basin is believed to date to the 1880s, when a combination of old grazing practices (primarily long term with high densities of stock) removed the existing grasses and began a cycle of intense runoff and gulying which exacerbated naturally occurring existing conditions (Marston and Anderson, 1991). Construction of dams and other activities that modify the natural flow regime of the basin have also played a part (USGS, 1956; Bray, 1996). Recovery has been slow and difficult in the lower elevation, more arid parts of the basin.

Livestock grazing and irrigated hay production are the primary land uses in the basin. Large areas of the lower basin are irrigated to produce a variety of crops and small grains. Oil and natural gas are the basin's primary mineral resources, but bentonite, gypsum, and sand and gravel are mined in certain areas as well. Recreation is an important land use in most of the basin, and some logging occurs in the higher elevations.

Portions of the Upper Wind River and Little Wind River Sub-basins (HUCs 10080001 and 10080002) are within the Wind River Indian Reservation boundary.

### **Upper Wind Sub-basin (HUC 10080001)**

The Upper Wind Sub-basin is the headwaters area for the Wind River, which flows into Boysen Reservoir. Land uses in the upper watersheds are primarily recreation, grazing, wildlife habitat, and timber production. Grazing, oil and gas production, and irrigated agriculture are primary land uses in the lower watersheds.

Limited *E. coli* sampling along the Wind River above the reservation boundary indicates that pathogens are a concern, so further monitoring will be conducted. The Dubois-Crowheart Conservation District (DCCD) has been sampling for water chemistry, as well as biological and physical parameters at several sites along the Upper Wind River and its tributaries, and completed a provisional report in 2004 (DCCD, 2004).

Habitat degradation has been documented by the Shoshone National Forest (SNF) on West Brooks Lake Creek, a small tributary to Brooks Lake. Because grazing management has been changed, monitoring by DEQ and the SNF will continue, to document improvement due to grazing management changes, and to determine the use

support of this stream.

Both SNF and DEQ have conducted monitoring on the Wind River and Warm Springs Creek. Results of that monitoring are inconclusive about aquatic life use support, so further monitoring is being scheduled. Monitoring of Trappers Creek, a tributary to Warm Springs Creek by DEQ and SNF indicate full support of aquatic life and cold water fisheries uses. Monitoring conducted by DEQ and SNF indicate that the East Fork of the Wind River above the Wiggins Fork and a tributary, Bear Creek, are fully supporting their aquatic life uses.

SNF has conducted stream stabilization work on the Wind River near the Tie Hack Memorial, and has worked with the grazing permittee to improve habitat and stream function.

Stabilization and revegetation work to control erosion and improve fish habitat in the Horse Creek drainage continues as a successful cooperative effort between SNF and WGFD. Monitoring conducted by DEQ and SNF indicate that portions of Horse Creek are in good physical condition, but further monitoring is needed to determine use support. Provisional data collected by DCCD indicate pathogens may be a concern in the lower watershed.

### **Little Wind Sub-basin (HUC 10080002)**

The Little Wind Sub-basin includes those watersheds, other than the Popo Agie Sub-basin, which drain into the Little Wind River. Primary land uses are grazing, irrigated agriculture, and oil and gas production. Waters within the diminished reservation boundaries are not discussed or included in the report, since the State of Wyoming does not have jurisdiction.

Many concerns have been identified with possible physical degradation along Beaver Creek, but BLM data shows physical conditions are generally improving. DEQ conducted monitoring in this drainage in 1999 and 2005, but a final assessment report has not been completed. Assessment of Little Beaver Creek indicates support of aquatic life and cold water fisheries uses; however the stream was impacted by heavy grazing and erosion.

### **Popo Agie Sub-basin (HUC 10080003)**

Headwaters of the Popo Agie Sub-basin are within the Shoshone National Forest. In the upper watersheds, recreation and livestock grazing are the primary land uses. Irrigated agriculture and residential development are the primary land uses in the Lander area.

The Middle Fork of the Popo Agie River near Lander is listed on the 303(d) List because of contact recreation impairment indicated by exceedences of the criteria for fecal bacteria and later, *E. coli*. The Popo Agie Conservation District (PACD) has developed a watershed plan to conduct further monitoring to identify sources of fecal contamination and voluntarily remediate them. PACD currently sponsors a 319 watershed improvement project that is remediating eligible septic systems in the Middle Fork watershed.

A 319 watershed improvement project sponsored by PACD in the Squaw and Baldwin Creek drainages was reportedly very successful in rehabilitating physical degradation of the streams. Reports from that project suggest the streams in these drainages are supporting their aquatic life uses.

Habitat degradation has been identified as a concern on portions of Twin Creek below its initial crossing of Highway 287. DEQ has monitored this reach, however a final assessment report has not been completed.

PACD has been conducting monitoring at 19 sites in the sub-basin since 1999 to assist with watershed planning

efforts and to determine baseline and trend conditions (PACD, 2001; WACD, 2004; PACD, 2005).

Assessment of Deep Creek, a tributary to Red Canyon Creek, indicates full support of class 2AB aquatic life uses.

#### **Muskrat Creek Sub-basin (HUC 10080004)**

The Muskrat Creek Sub-basin is in the Gas Hills area east of Riverton. Primary land uses are livestock grazing, oil and gas production and uranium production. Since 1990, AML has completed remediation of five former uranium mine sites; two additional sites had ongoing work in 1996-97. Data which could be used for an assessment are not available at this time. DEQ investigated Muskrat Creek in 1999 and found no flow in the creek. The Lower Wind River Conservation District has established a monitoring location on Muskrat Creek near its confluence with the Wind River as part of a Section 319 assessment project, however, the lack of flow in this watershed has prevented the collection of credible water quality data.

#### **Lower Wind Sub-basin (HUC 10080005)**

The Lower Wind Sub-basin is wing shaped - it includes the Muddy and Fivemile Creek drainages on the west side of Boysen Reservoir and the Poison Creek drainage on the east side. Primary land uses are grazing, irrigated agriculture, and oil and gas production. Flow from both the eastern and western drainages empties into Boysen Reservoir. The Wind River, from Boysen dam downstream to the Wedding of the Waters at the lower limit of this sub-basin, is a Class 1 water.

Ocean Lake is on the 303(d) List for not supporting its aquatic life uses, due to physical degradation from irrigation return flows carrying sediment into the lake, which reduces aquatic life production. A watershed improvement project completed by the Lower Wind River Conservation District (LWRCD) dramatically reduced the sediment loading to the lake. Monitoring conducted on Ocean Lake by DEQ and WGFD show that most of the irrigation drains in the watershed improvement project have reduced their sediment loads, but other areas in the watershed still contribute high sediment loads. There is also high nutrient loading into the lake. However, the primary problem in Ocean Lake is the excessive sediment that has already been deposited in the lake. Because Ocean Lake is so shallow, wave action frequently re-suspends this sediment, significantly reducing light infiltration and limiting growth of aquatic plants that would otherwise stabilize the deposited sediment and improve water quality. Ocean Lake water quality problems are further exacerbated by the high nutrient levels. Fixes to Ocean Lake must not only reduce sediment loading, but must also involve stabilization of the sediment already in the lake. Additionally, the nutrient loading (including the nutrient load already in the lake) ,need to be reduced so that a reduction in suspended sediment and the associated increase in light infiltration do not cause excessive algal growth.. The LWRCD has formally committed to developing a watershed plan to address issues at Ocean Lake. A TMDL for Ocean Lake is expected to be completed in 2008.

Poison and Muddy Creeks, tributaries to Boysen Reservoir, were initially on the 303(d) List, because analysis of USGS data indicated the contact recreation use on these streams was threatened due to occasional high counts of fecal coliform and *E. coli* bacteria. Further monitoring by the Lower Wind River Conservation District under a 319 grant showed exceedences of the *E. coli* criterion indicating primary contact recreational uses are not fully supported on both of these streams. Muddy Creek is not supporting its contact recreation use between the Wind River Indian Reservation and Boysen River. Poison Creek is impaired from an undetermined distance above and below Highway 26, between Boysen Reservoir and Shoshoni. This change in use support status from “threatened” to “not supporting” will not affect the timeline of any TMDL development or Watershed-based planning efforts.

### **Badwater Creek Sub-basin (HUC 10080006)**

The Badwater Creek Sub-basin is on the northeast side of Boysen Reservoir. Land uses are primarily livestock grazing and oil and gas production in the Lysite/Lost Cabin area. AML completed remediation of a mine site in the Hoodoo Creek drainage. LWRCD has established a monitoring location on Badwater Creek near its confluence with Boysen Reservoir as part of a Section 319 assessment project. The lack of flow in this watershed however, has resulted in limited collection of credible water quality data. USGS data suggests that this watershed transports large amounts of sediment to Boysen Reservoir during runoff events.

### **Upper Bighorn Sub-basin (HUC 10080007)**

Headwaters of the Upper Bighorn Sub-basin are in the southern end of the Absaroka Range and the Owl Creek and Bridger Mountains. Grazing and oil and gas extraction are the basic land uses, along with irrigated agriculture in the lower elevations. Several hundred acres in the Owl Creek and Kirby Creek drainages have been mined for bentonite. Thermopolis Hot Springs contributes a naturally high TDS load to the Bighorn River, and also is the source of a natural temperature increase (Darton, 1906). Numerous watershed studies have been completed in the Fifteen Mile Creek drainage since the 1960's. These studies help provide information on potential natural vegetation, and responses of vegetation and stream morphology to different grazing strategies, which can be applied to much of the Bighorn Basin.

DEQ has conducted monitoring on the Bighorn River and many other streams to determine support of aquatic life uses. Alkali Creek was investigated in 2001 and was found to be dry. Buffalo Creek was investigated 2001 and 2004 and was found to be dry both times. Owl Creek also was investigated in 2001 and 2004, and Lake, Red Canyon, and Kirby Creek were investigated in 2001. Assessment reports have not been completed for any of these streams.

The Bighorn River near Basin was placed on the 303(d) List in 2000 for impairment due to exceedences of the criteria for fecal bacteria. WDEQ conducted monitoring in 2000, which showed that the impaired reach extends from below the Greybull River (in HUC 10080010) upstream to the Nowood River. Above the Nowood River, the Bighorn River is listed as threatened on the 303(d) List for contact recreation uses due to high levels of fecal bacteria. Washakie County Conservation District (Washakie CCD) is pursuing watershed planning efforts within its district (WACD, 2005). Washakie CCD has collected *E. coli* samples in the Bighorn River upstream of the confluence with the Nowood River, but data from the monitoring to-date are not available for this report.

Red Canyon Creek drains a watershed of easily eroded red soils developed from fine-grained red sandstone, siltstone, and shale. When the creek does flow, it delivers a distinctively colored sediment load to the Bighorn River. The relative influence of natural causes and development activities cannot be determined with available information.

Owl Creek flows through fine grained sandstone, siltstone, and shales. Sodium and sulfate salts from these shales, together with silt and clay, naturally impact water quality (Ogle, 1992). In 1995, AML reclaimed a long-abandoned sulfur mine which had been affecting water quality in the Owl Creek watershed. Owl Creek is listed on the 303(d) List as threatened for not supporting its contact recreation use based on analysis of fecal bacteria data collected by DEQ and the USGS. Hot Springs Conservation District (HSCD) has been monitoring *E. coli*, however those data were not available for this report. HSCD has sponsored the formation of the Owl Creek Watershed Planning Committee. This entity finalized a watershed plan in 2006 and is implementing a number of BMPs in accordance with that plan (WACD, 2007).

Extensive erosion has occurred in the Kirby Creek drainage due to a combination of channel manipulation, historic overgrazing, and responses to flow regime changes in the Bighorn River (Hurley, 2003; Bray, 1996). A 205j water quality assessment of the drainage, sponsored by HSCD, was completed and submitted to DEQ. The

report (Hurley, 2003) identifies fecal bacteria as a problem in Kirby Creek, which has been placed on the 303(d) List. In addition, a USGS synoptic study included three sites on Kirby Creek. *E. coli* counts at each of these three locations exceeded 500 colonies per 100 ml. (USGS, 2003). A Coordinated Resource Management (CRM) group is addressing these problems in the Kirby Creek drainage, utilizing 319 and other moneys. HSCD currently sponsors a Kirby Creek steering committee and has a 319 implementation project in the Kirby Creek watershed to help address water quality concerns. Stream structures have been installed in much of West Kirby Creek to stabilize banks and allow the stream to access its flood plain. A formal commitment to develop a watershed plan on Kirby Creek was received from HSCD in March 2006 and a final plan is anticipated in 2008.

Cottonwood Creek receives discharges from the Hamilton Dome Oil Field. Data collected in Cottonwood Creek below the discharges show high concentrations of both chloride and selenium. However, because the discharge water is used for irrigation and the oil field is an important part of the local economy, a Use Attainability Analysis (UAA) was conducted and approved on Cottonwood Creek, with site specific criteria of 43 ug/L for selenium and 860 mg/L for chloride. Therefore Cottonwood Creek has been delisted from the 303(d) List.

Grass Creek is a tributary to Cottonwood Creek. Assessment of DEQ monitoring data indicates that aquatic life uses are supported in the upper watershed, however, because legal flow depletions remove most, if not all of the water down stream of the irrigation diversion in NENE Section 23, T46N, R99W, its aquatic life uses are correspondingly affected. This reach of Grass Creek is impacted by pollution, rather than a pollutant, and therefore does not require a TMDL and is in Category 4C.

Nowater, Sage, Fifteen Mile, and Slick Creeks, tributaries to the Bighorn River, are listed on the 303(d) List because analysis of USGS data indicate the contact recreation use on these streams is threatened due to occasional high counts of *E. coli*. Washakie County Conservation District (Washakie CCD) has a 319 grant addressing AFO and septic problems and conducting *E. coli* monitoring and has completed a watershed plan. Washakie CCD has collected *E. coli* samples in these creeks, but data from the monitoring to-date are not available for this report.

Washakie CCD conducted monitoring in 1999 to determine aquatic life use support of Nowater Creek, Gooseberry Creek, Cottonwood Creek, and Fifteen Mile Creek. Data from that monitoring was submitted to DEQ, but was not sufficient to make use support determinations. Additional monitoring by the conservation district occurred in 2006 and 2007, however those data were not available for this report.

### **Nowood Sub-basin (HUC 10080008)**

Headwaters of the Nowood Sub-basin are on the southwestern side of the Big horn Mountains. Livestock grazing and oil and gas extraction are the major land uses in upper elevations. In lower elevations, irrigated agriculture is the primary land use and the largest consumptive water user. Bentonite is mined in Wild Horse Draw.

Fecal bacteria samples collected by DEQ near the mouth of the Nowood River indicate an exceedence of the contact recreation criterion, hence the Nowood River is not supporting that designated use. The impaired reach is listed on the 303(d) List as extending from the confluence with the Bighorn River upstream an undetermined distance. A number of homes and businesses in Manderson were found to be discharging largely untreated wastewater into the Nowood River, just above the Bighorn River. The Town of Manderson secured funding for a new mechanical treatment system which uses a geotex filter with microbes and circulates and recirculates the waste water through these filters to reduce nitrogen and total suspended solids. The effluent then goes through an ultra violet disinfectant system before discharging. Reports indicate the system is now operating properly, however affects on *E. coli* loading to the Nowood River have not yet been determined.

Washakie CCD conducted monitoring in 1999 on the Nowood River, Buffalo Creek, and Otter Creek to determine aquatic life use support, and submitted the data to DEQ. However, the data was not sufficient to make use support determinations. Additional monitoring by the conservation district occurred in 2006 and 2007, however those data were not available for this report.

Paintrock Creek, a tributary to the Nowood River, is on Table C of the 303(d) List because analyses of DEQ data indicate the contact recreation use is threatened due to occasional high counts of fecal bacteria. South Big horn Conservation District (SBHCD) has a 319 grant and has collected samples on Paintrock Creek, however, data were not available for this report. Watershed planning efforts were approved by DEQ and are underway on Paintrock Creek and the Nowood River (WACD, 2005).

Assessment of Soldier Creek, a tributary to the South Fork of Paintrock Creek, indicates full support of coldwater fisheries and aquatic life uses.

Assessment of Canyon Creek, a tributary to Tensleep Creek, indicates full support of its aquatic life and coldwater fisheries uses. However, some areas of the lower watershed have had willows removed in the past, which has led to some unstable banks and increases in summer water temperatures.

### **Greybull Sub-basin (HUC 10080009)**

Headwaters of the Greybull Sub-basin are in the Absaroka Range within the Shoshone National Forest. The foothills portions of the sub-basin are a mix of BLM, state, and private lands, and the basin portions are primarily BLM, with private lands adjacent to streams. The sub-basin has three major irrigation reservoir projects. Summer flows in the Greybull River at the confluence with the Bighorn River are reportedly almost entirely irrigation return water and at some times there may be minimal to no flow, due to appropriations on the river (RPO, 1979). Livestock grazing and areas of oil and gas extraction are major land uses, with irrigated agriculture nearby and adjacent to the major tributary streams.

The Greybull River is on the 303(d) list because exceedences of the criteria for fecal bacteria from Greybull upstream to Sheets Flat Bridge indicate it is not supporting its use for contact recreation. Although high fecal bacteria counts have been occasionally recorded as far upstream as Meeteetse, samples were collected too infrequently in upstream reaches to develop a valid geometric mean to compare with criteria. Meeteetse and South Big Horn Conservation Districts have monitored on the Greybull River. High water temperatures recorded during the recent drought raise concerns about the river's ability to support its use as a cold water fishery during low flows in summer. Future monitoring is required to better understand the temperature regime and to determine sources of fecal bacteria. Watershed planning is occurring for the Greybull River watershed in both Big Horn and Park Counties.

### **Big Horn Lake Sub-basin (HUC 10080010)**

The Big Horn Lake Sub-basin includes those areas, other than the Dry Creek and Shoshone River Sub-basins, which drain into the Bighorn River or Big Horn Lake below the Greybull River. Shell Creek is the largest watershed in the Big Horn Lake Sub-basin. Its upper reaches are sited on the western slope of the Big Horn Mountains within the Big Horn National Forest. It flows across National Forest, BLM, and private lands before it confluences with the Bighorn River. In lower elevations, the tributaries drain large areas of marine shales and other fine-grained geology, which produce naturally high TDS loading to the Bighorn River.

Big Horn Reservoir was created by the construction of Yellowtail Dam in Montana in 1963-67 for irrigation, power generation, and flood control. The upper third is in Wyoming; the lower two-thirds of the lake are in Montana. Livestock grazing, recreation, and logging are the primary land uses, with bentonite mining on both sides of Shell Creek east of Greybull and also northeast of Spence. Gypsum is also mined in the area. The

Porcupine Falls area in the Porcupine Creek Drainage is the site of a historic late 1800s-early 1900s placer and lode gold mining operation. Both mercury based amalgamation and potassium cyanide were used for gold extraction. In 1993, the Forest Service and Bureau of Reclamation began investigating reports that mercury from the historic mine was present in Porcupine Creek. However, sampling showed no mercury levels of concern. DEQ has also monitored Porcupine Creek, including mercury in fish tissue. Those data show that aquatic life and fish consumption uses are fully supported.

WGFD has conducted fish tissue analysis of fish from Big Horn Lake. Because methyl mercury concentrations in the larger predatory fish (channel catfish, sauger, and walleye) exceed the guideline of 0.5 mg methyl mercury/kg fish, Wyoming Department of Health has issued a fish consumption advisory in December 2007. Women of childbearing age, pregnant women, nursing mothers and children under 15 are advised not to eat channel catfish, sauger, and walleye from Big Horn Lake. Other people should eat no more than one to two meals per month of these fish. <http://www.health.wyo.gov/news.aspx?NewsID=134>. Because methyl mercury concentrations tend to be highest in older, generally larger fish, it is also recommended that smaller fish be consumed rather than larger fish. Chapter 1 does not currently have a numeric methyl mercury criterion for fish tissue. Fish tissue criteria for bioaccumulating substances are based on average daily consumption. Wyoming's water column numeric criteria for fish consumption are based on an average consumption of 6.5 grams fish/day. Extrapolating this quantity of fish consumption would give a fish tissue "criterion" of 1.0 mg methyl mercury/kg fish (1.0 ppb) (USEPA, 2001). This concentration (1.0 ppb) has only been exceeded in one 24-inch channel catfish sampled by WGFD in Big Horn Lake. Because the vast majority of game fish have methyl mercury concentrations below 1.0 ppb, Big Horn Lake will not be listed on the 303(d) List for methyl mercury. The Montana Department of Public Health and Human Services has issued a similar fish consumption advisory on the Montana portion of Big Horn Lake.

Fecal bacteria monitoring on the Bighorn River below its confluence with the Greybull River indicate it is not supporting its contact recreation use, however, samples collected just upstream from Big Horn Lake did not exceed criteria. Therefore, a segment of the Bighorn River, extending from the Greybull River downstream to an undetermined distance above Big Horn Lake (a continuation of the segment listed upstream in HUC 10080007), is listed on the 303(d) List. Further monitoring will be scheduled to better delineate the impaired reach as well as to identify other sources of fecal bacteria.

Fecal bacteria samples collected near the mouth of Shell Creek indicate that this creek does not meet its contact recreation use from its confluence with the Bighorn River upstream an undetermined distance. Granite Creek, a tributary to Shell Creek, was monitored for aquatic life use support and sampled for fecal bacteria. The results of that monitoring indicate that it is not meeting its contact recreation uses from its confluence with Shell Creek upstream approximately 4 miles to the vicinity of Antelope Butte Ski Area. The data and field visits to the creek by DEQ suggest the leach field at the Antelope Ski Area may have been the significant contributing source for this impairment. The ski area has not been active since the 2004-05 winter season, however the Forest Service has started the process of finding a new operator for the facility. The DEQ conducted supplemental *E. coli* monitoring on Granite Creek in the fall of 2005. These provisional data do not show the dramatic increase in pathogen levels bracketing the ski area as were seen in 2001 and suggest the inactivity at the ski area may have eliminated the loading source. Bighorn National Forest (BNF) personnel have been conducting monthly bacteria monitoring of Granite Creek below Antelope Butte since late 2004. Provisional data submitted to DEQ show some elevated *E. coli* numbers in the creek. The maximum single sample numbers observed during the primary contact recreation seasons in 2005 and 2006 were 1,120 and 276 CFUs/100 mL, respectively. These data suggest loading sources other than the ski area are found in the watershed. Additional BNF monitoring on Granite Creek will assist in identifying loading sources and in the development and implementation of water quality improvement BMPs. Both Shell and Granite Creeks are on the 303(d) List. Although Granite Creek is not meeting its contact recreation use, it does fully support its aquatic life uses. Mail Creek is a Class 1 tributary to Shell Creek, since it is in the Cloud Peak Wilderness Area. Assessment of Mail Creek indicate full support of its aquatic life uses. In the lower reaches of Shell Creek, WGFD information

suggests impacted riparian area and flow diversions may have degraded water quality from Shell Canyon to the Bighorn River.

Beaver Creek is listed on the 303(d) List due to high fecal bacteria counts recorded by USGS indicating it is threatened for its contact recreation use.

SBHCD has conducted monitoring on Shell Creek and Beaver Creek under a 319 grant (WACD, 2004). Results from that monitoring were not available for this report.

Crooked Creek (Class 2AB) flows into Wyoming from Montana and then flows into Big Horn Lake. Monitoring by DEQ shows that its aquatic life uses are fully supported from the irrigation diversion in SWNW Section 29, T58N, R95W upstream to the Montana state line. However, reductions of flow downstream from this diversion inhibit aquatic life to the extent that fisheries and aquatic life uses are affected accordingly, even in some sections below springs that appear to have perennial flows. This reach of Crooked Creek is impacted by pollution, rather than a pollutant which would require a TMDL, and is in Category 4C.

Weight-of-evidence assessment of Porcupine Creek indicates aquatic life uses are fully supported in the watershed.

### **Dry Creek Sub-basin (HUC 10080011)**

Land uses in the Dry Creek Sub-basin are primarily livestock grazing, recreation, and oil and gas development. Much of this sub-basin has high erosion rates due to fragile soils and historic livestock use (RPO, 1979). In many areas of the Dry Creek Sub-basin, as well as other areas of the Bighorn Basin, the uplands are dominated by blue grama. Plant community modifications like this usually result in higher peak flows and reduced base flows, (i.e., more precipitation runs off and erosion is elevated on those areas that have been converted to blue grama dominance). Forage production is also reduced as a result of the change in plant species composition and reduced effective precipitation. Perennial native bunchgrasses have responded favorably to livestock grazing management changes that have been implemented in the area. The western half of the Dry Creek Sub-basin has been identified by the BLM as a high priority for watershed improvement.

Concerns have been expressed about precipitates in Oregon Coulee and Coalmine Gulch below the Oregon Basin Oil Field. According to the BLM, cattle and wild horses may avoid drinking the water in portions of Dry Creek below these areas.

BLM data indicate that livestock grazing practices may be preventing woody vegetation recruitment in the lower portion of the North Fork Dry Creek drainage, and this area is thought to be contributing excessive sediment to the Dry Creek system.

Lower Dry Creek is on the 303(d) List due to high fecal bacteria counts recorded by USGS indicating it is threatened for its contact recreation use. SBHCD has conducted monitoring on Dry Creek under a 319 grant (WACD, 2004). Results from that monitoring were not available for this report. A watershed plan sponsored by SBHCD was developed and approved in 2007 (WACD, 2007).

### **North Fork Shoshone River Sub-basin (HUC 10080012)**

The headwaters of the North Fork Shoshone River Sub-basin are situated in the volcanic geologic materials of the northern Absaroka Range. Primary land uses are recreation, with livestock grazing and irrigated hayland in the lower watersheds. Soils are formed from Absaroka volcanic geologic materials, and are highly erodible. Mass wasting and landslides are common, and one landslide event in the spring of 1997 contributed hundreds of thousands of cubic yards of sediment to Middle Creek. Portions of this watershed burned in 1988 and again in

2001, which is thought to have increased the sediment loading. This increased sediment loading has raised concerns about the amount of sediment being deposited in Buffalo Bill Reservoir. However, numerous watershed assessments indicate that despite these conditions, streams in this sub-basin are meeting their aquatic life uses above the Shoshone National Forest boundary.

### **South Fork Shoshone River Sub-basin (HUC 10080013)**

Most of the South Fork Shoshone River Sub-basin is within roadless or wilderness areas in the Shoshone National Forest, so human impact to water quality is minimal in much of the sub-basin. The dominant geology within the higher elevations is of volcanic origin and very unstable, so natural sediment loading is very high.

Parts of the mainstem South Fork of the Shoshone River have experienced considerable bank erosion, due to attempts to control the river through bank modifications, which did not adequately consider natural hydrologic processes. As a result, when a “fix” was attempted in one stretch, it often caused the river to erode banks in adjoining stretches as the river adjusted. However, landowners have now implemented measures to allow flows to disperse energy on the floodplain and reduce erosion (WACD, 2004). BLM data show watershed degradation in the upper drainages of Timber and Deer Creeks, on the flank of Sheep Mountain. This is thought to be due to past livestock grazing practices, combined with atypical high flow events.

### **Shoshone River Sub-basin (HUC 10080014)**

The Shoshone River receives water from Buffalo Bill Reservoir and flows into Big Horn Lake.

The settling pond effect of Buffalo Bill Reservoir removes sediment and many other potential water quality impairments. However, fine sediment deposited on the reservoir bottom becomes an air quality issue when the reservoir is low and the sediments are exposed to the high winds that frequent the area. The Bureau of Reclamation built dust abatement dikes to address this problem (WACD, 2004).

Irrigation development began in the early 1900's and included the first federal reclamation project. Buffalo Bill Dam and Reservoir (originally called Shoshone Dam), was built to contain runoff from the North and South Forks of the Shoshone River, and store water, primarily for irrigation. The reservoir is also used for recreation, as well as generating electricity.

Bottomlands and flat benches along the Shoshone River are extensively irrigated and farmed. Most of the other uplands are BLM land and are primarily grazed by livestock. Portions of the sub-basin have extensive oil and gas development, and bentonite and gypsum are presently being mined.

Most of the BLM land lying south of the river and north and east of Corbett Dam has been identified by the BLM as a high priority for watershed improvement. Much of this area has elevated erosion rates due to historic livestock impacts and subsequent conversion of native bunchgrasses to blue grama. A higher proportion of the precipitation runs off, which reduces effective soil moisture and further reduces forage production. The area contains significant amounts of badlands geology, which naturally produce high runoff and erosion rates. BLM data also indicates roads and grazing may be causing excessive erosion in parts of the Deer, Coon, and Whistle Creek watersheds.

The Cody Conservation District (Cody CD) completed an *E. coli* assessment 319 project in the upper Shoshone River watershed in late 2005. Data indicate *E. coli* concentrations are minimal immediately below Buffalo Bill Reservoir and increase gradually downstream to a point downstream of Corbett Dam. Those data do not

suggest a threatened or impaired condition on the Shoshone River within the reach assessed.

Sage Creek, which flows into the Shoshone River, a little east of Cody, may be a possible contributor of excessive sediment and nutrients to the Shoshone River due primarily to irrigation return flows into Sage Creek, and areas of poor riparian condition along portions of Sage Creek and upper Hoodoo Creek (SCS, 1994). The Cody CD assessment included some synoptic *E. coli* sampling on Sage Creek. Data from that assessment suggest there may be pathogen concerns in this water.

Dry Gulch confluences with the Shoshone River just upstream of a public boat ramp on the Shoshone River. Although Dry Gulch is naturally ephemeral, it receives irrigation return flows, so it flows during most of the recreation season. Sampling conducted by the Cody CD indicates that Dry Gulch exceeds the *E. coli* criterion, as does the Shoshone River at the boat ramp, before thorough mixing takes place in the river. Therefore Dry Gulch has been added to the 303(d) List.

In 2007, a malfunction in Willwood Dam caused a large sediment plume to be released downstream, which killed thousands of fish. Similar sediment releases have occurred in the past. The Bureau of Reclamation which owns the dam and the irrigation company which operates the dam is working with DEQ and WGFD to remedy the problem.

The BLM portion of Sulphur Creek (about 1.25 miles) is very wide and shallow and BLM data indicates riparian vegetation in poor condition. Historically, this part of the stream experienced season-long cattle grazing. However, a deferred rotation livestock grazing strategy has been implemented on the majority of the BLM portion of this stream, which should improve the condition of the riparian vegetation. Produced water discharges from oil and/or gas development in the upper watershed have been permitted for the discharge of TDS and other pollutants at concentrations protective of existing designated uses.

BLM data indicate portions of Cottonwood Creek, north of Cody, are incised and actively eroding, probably in response to historic land uses such as mining, livestock grazing, and development of several springs for a fish hatchery and livestock waters. In addition, there is a failed and abandoned irrigation structure that has possibly initiated headcutting of the drainage just north of agricultural land on the outskirts of Cody. Currently BLM is addressing water quality concerns associated with livestock grazing on the BLM portions of the watershed. The former Yellowstone Refinery property is located immediately adjacent to Cottonwood Creek. The Solid and Hazardous Waste Division of DEQ is currently working with the responsible party to clean up the refinery property including groundwater contamination and its potential impacts to Cottonwood Creek.

Excessive sediment has been identified as a possible water quality problem in Alkali Creek, which heads on Heart Mountain and drains Ralston Flats (SCS, 1994).

Samples which exceed the fecal bacteria criteria for primary contact recreation have been collected by DEQ from Bitter Creek near Garland, and this stream is on the 303(d) List. The Powell Clarks Fork Conservation District (PCFCD) has monitored water quality at five sites in the drainage and has completed a watershed plan. Data from that monitoring effort were not complete due to a theft of PCFCD computer hardware (including records and QA/QC information). The evaluation data from this assessment substantiate the impairment and suggest the extent of impairment may extend upstream as far as the Lane 8 bridge (approximately 2.5 miles upstream of the City of Powell Wastewater Treatment Plant). A more definitive location for this impairment can not be given until credible data are collected.

Information from BLM indicates bentonite and gypsum mining and roads may be creating some water quality problems around Little Sheep Mountain in the eastern part of the Shoshone River Sub-basin. Excessive alkalinity in soils in the Lovell Lakes area south of Lovell may be due to flood irrigation and poor drainage of these naturally alkaline soils.

Salinity, excessive sediment, nutrients, and pathogens have been identified by BLM, DEQ, WGFD, and the NRCS as possibly impacting water quality in the Shoshone River. Extensive pesticide sampling by the USGS indicates pesticides are rarely measured above detection levels in the river. Shoshone Conservation District has monitored the Shoshone River for two years under a 319 assessment project (WACD, 2004). That project ended in March 2005, but those data have not been submitted and are not available for this report.

In 2000 and 2001, DEQ conducted fecal bacteria monitoring in several of the drainages in the lower Shoshone River watershed to better delineate the extent of impairment. This was done in response to concerns by an area physician who treated several cases of severe gastro-intestinal illness in patients who had been swimming in area waters. Results of the monitoring indicate several of the waters had exceedences of the fecal bacteria criteria and are impaired for contact recreation use. The following waters in the Lower Shoshone River watershed are on the 303(d) List:

The Shoshone River, from its confluence with Big Horn Lake upstream an undetermined distance.

Bitter Creek, from its confluence with the Shoshone River upstream an undetermined distance above Powell.

Sage Creek, from its confluence with the Shoshone River upstream an undetermined distance above Big Wash.

Polecat Creek, from its confluence with Sage Creek upstream an undetermined distance.

Big Wash, from its confluence with Sage Creek upstream to Sidon Canal.

Whistle Creek, from its confluence with the Shoshone River upstream an undetermined distance.

Additionally, the lower reach of Foster Gulch, is on the 303(d) List due to high fecal bacteria counts recorded by USGS indicating it is threatened for its contact recreation use.

The sources of fecal contamination in the streams listed above have not been determined, although a 1978 Section 208 study identified many cases of poorly operating septic systems in the watershed. PCFCD has received a Section 319 grant to rehabilitate eligible septic systems in the Bitter Creek watershed. County commissioners and conservation districts are investigating establishment of a Clean Water Act - State Revolving Loan funding program to provide low interest loans for additional septic system rehabilitation. The Shoshone Conservation District (SCD) has also initiated monitoring at 16 sites and a septic rehabilitation program using district funds. The SCD completed a watershed plan in 2006 (WACD, 2007). Data from the district's monitoring program were not available for this report.

Information from SCD, WGFD, and a Cooperative River Basin Study (SCS, 1994) suggest that salinity, oil, nutrients, and streambank degradation may also be problems in Sage Creek in northwest Big Horn County. The BLM also identified these concerns in one of its tributaries, Polecat Creek. Possible sources may be bentonite mining, roads, farming, or oil production. SCD has conducted monitoring on these streams, but the data were not available for this report (WACD, 2004).

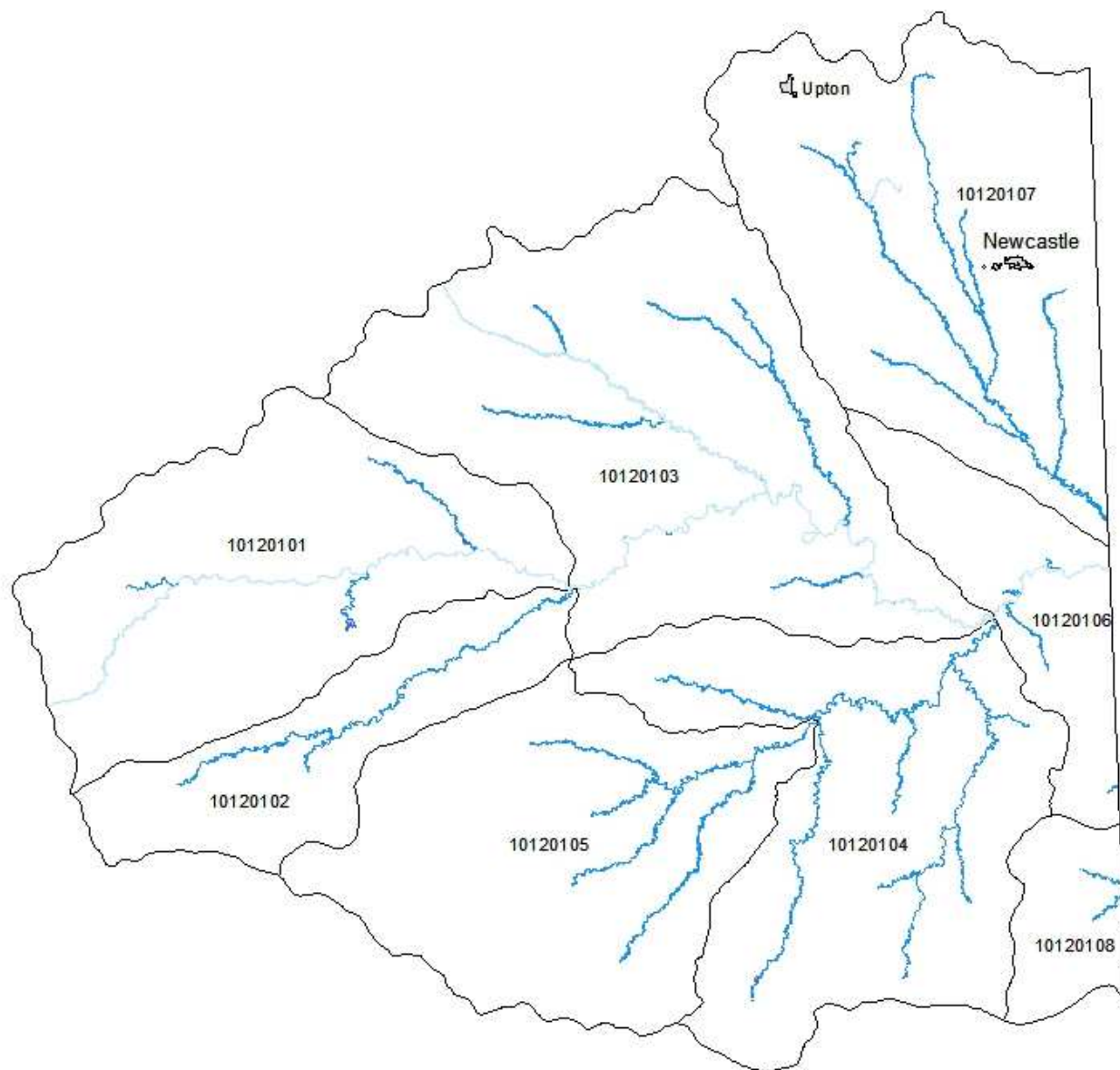
Monitoring was conducted by DEQ on Sage, Alkali, Polecat, and Whistle Creeks, as well as the Shoshone River, in 2001. Preliminary data evaluation is inconclusive on aquatic life use support, therefore the streams are being considered for additional monitoring.

**Little Bighorn River Sub-basin (HUC 10080016)**

The upper portion of the Little Bighorn River Sub-basin headwaters is in Wyoming before draining into Montana. Except for a few main stem miles near the border, most reaches in this sub-basin are within the Bighorn National Forest. Grazing, recreation, logging, and some recreational gold mining are the primary land uses. Stream habitat inventories were collected by the Bighorn National Forest. Fish habitat enhancement and changes in grazing management practices have addressed some past concerns about the effects of increasing sedimentation on water quality.

DEQ conducted monitoring on the Little Bighorn River and West Pass Creek in 2000. The data indicates full support of aquatic life uses in both these waters.

# Cheyenne River Basin 2008



## **Cheyenne River Basin**

The Cheyenne River Basin lies in eastern Wyoming and drains areas of the Powder River geologic basin as well as the southern portion of the Black Hills uplift. Other than the southern Black Hills and some breaks and escarpments, most of the basin consists of rolling plains. The Thunder Basin National Grasslands occupies a large portion of the central part of this basin. Streams originating in lowland areas are usually intermittent or ephemeral, and most perennial streams originate in the Black Hills or Pine Ridge escarpment. Because the sedimentary rocks in the Powder River geologic basin contribute significant levels of iron, manganese, and sulfate to surface waters, several streams in that portion of the basin have had the secondary (aesthetic) drinking water criteria for iron and manganese removed. Primary land uses are grazing, with areas of hay production, coal mining, oil and gas production, and coalbed methane production, primarily in the western portion of the basin .

### **Antelope Creek Sub-basin (HUC 10120101)**

The headwaters of the Antelope Creek Sub-basin are east of Edgerton. Land uses are primarily grazing and oil production, with coal mining in the northeastern third of the sub-basin. A reach of Antelope Creek has been nominated as a possible plains reference stream.

Antelope Creek contains many beaver dam complexes in its lower reach which store water, but keep it from reaching the Cheyenne River except for periods of higher flows. Concentrations of dissolved iron in Antelope Creek occasionally exceed the criterion for protection of aquatic life, however this is likely due to the natural geology and spring dominated hydrology. Assessment by DEQ indicates a benthic community comparable to reference condition for intermittent streams in this basin, and WGFD data show a diverse population of native non-game fish as well as warm water game fish, indicating it should be classified as 2ABww water. Although Antelope Creek is currently classified as 3B, the weight-of-evidence indicates it is fully supporting warm water game fishery uses, as well as its designated class 3B aquatic life uses.

### **Dry Fork Cheyenne Sub-basin (HUC 10120102)**

Land uses in the Dry Fork Cheyenne Sub-basin are primarily grazing and oil and gas development. Uranium exploration and mining occurred from the 1950s through the 1980s in the southern portion of this sub-basin, an area where all reaches are non-perennial.

### **Upper Cheyenne Sub-basin (HUC 10120103)**

Coal mining occurs in the Upper Cheyenne Sub-basin east of Wright. Other land uses include grazing and oil and gas development. The Cheyenne River in this sub-basin typically has an intermittent flow regime, with flows reduced to standing pools of water fed by springs during the drier seasons.

Assessment by DEQ indicates the Cheyenne River in this Sub-basin, from Lance Creek upstream to the Dry Fork of the Cheyenne River, contains a diverse assemblage of benthos and fish typical of this flow regime, and is considered fully supporting of its fisheries and aquatic life uses.

Flows in Little Thunder and Black Thunder Creeks are ephemeral to intermittent with areas of perennial pools fed by springs or stored behind beaver dams. Although Little Thunder Creek receives flows from oil treaters and CBM production, most if not all of the flow is lost to evaporation and infiltration, or are stored behind beaver dam complexes before reaching Black Thunder Creek. Monitoring by WGFD on Black Thunder Creek showed a community of native non-game fish as well as warm water game fish, indicating it should be

classified as 2ABww water. The benthic community is also comparable to reference condition for intermittent streams in this basin. Based on review of all available data Black Thunder Creek is considered fully supporting of its designated aquatic life uses as well as warm water game fishery uses.

Niobrara County Conservation District (Niobrara CCD) has raised concerns about coal bed methane (CBM) produced water discharges into the Cheyenne River basin and has conducted monitoring on the Cheyenne River since 1999. However there is no evidence that flows from CBM discharges reach the Cheyenne River.

Niobrara CCD has conducted monitoring on Snyder Creek, and their data show that Snyder Creek also has an ephemeral to intermittent flow regime.

#### **Lance Creek Sub-basin (HUC 10120104)**

Land uses in the Lance Creek Sub-basin include grazing, and oil and gas development. Niobrara CCD has conducted monitoring on Lance Creek.

#### **Lightning Creek Sub-basin (HUC 10120105)**

Land uses in the Lightning Creek Sub-basin are chiefly grazing, with some oil and gas development. Monitoring by DEQ identified a reach of Lightning Creek that is being considered as a least-impacted reference stream for the plains.

#### **Angostura Reservoir Sub-basin (HUC 10120106)**

Land uses in the Angostura Reservoir Sub-basin are primarily grazing, with some oil and gas development.

The Cheyenne River in this sub-basin generally has perennial flow, however at times the flow is reduced to standing pools of water fed by springs. Assessment by DEQ indicates that while there are occasional exceedences of the dissolved iron criterion during extremely low flows, the source of the iron is thought to be completely natural and due to the marine geology. The Cheyenne River from the South Dakota Line upstream to its headwaters contains a diverse assemblage of benthos and fish typical of this flow regime, and weight-of-evidence assessment indicates it is fully supporting its fisheries and aquatic life uses.

The Cheyenne River in South Dakota is listed as impaired on their 2006 303(d) list due to SAR and high TDS (Wyoming / South Dakota state line to Beaver Creek) and due to SAR, TSS, and TDS (Beaver Creek to Angostura Reservoir), and TMDLs are being developed there. The USGS has sampled water quality on the lower Cheyenne River immediately upstream of the state line as part of the CBM assessment project. Data collected in the 2004, 2005 and 2006 water years show elevated SAR, EC, TDS, and TSS values in the river prior to it flowing into South Dakota. It is currently unknown the levels of these pollutants that are naturally occurring versus anthropogenic.

#### **Beaver Creek Sub-basin (HUC 10120107)**

Land uses in the Beaver Creek Sub-basin include grazing, hay production, and oil and gas development. Many of the streams in this sub-basin originate in the Black Hills and are perennial.

Poison Creek flows through the Osage Oil Field into Beaver Creek near Osage. Numerous small oil seeps, some of which reach Poison Creek, had been identified in the watershed and Poison Creek was listed on the 303(d) List. Because of the considerable exploration and production of both oil and bentonite, it was difficult to determine whether the seeps were natural, human induced, or a combination of the two. The Wyoming Oil and Gas Conservation Commission determined it would be more efficient to mitigate the problems than to attempt

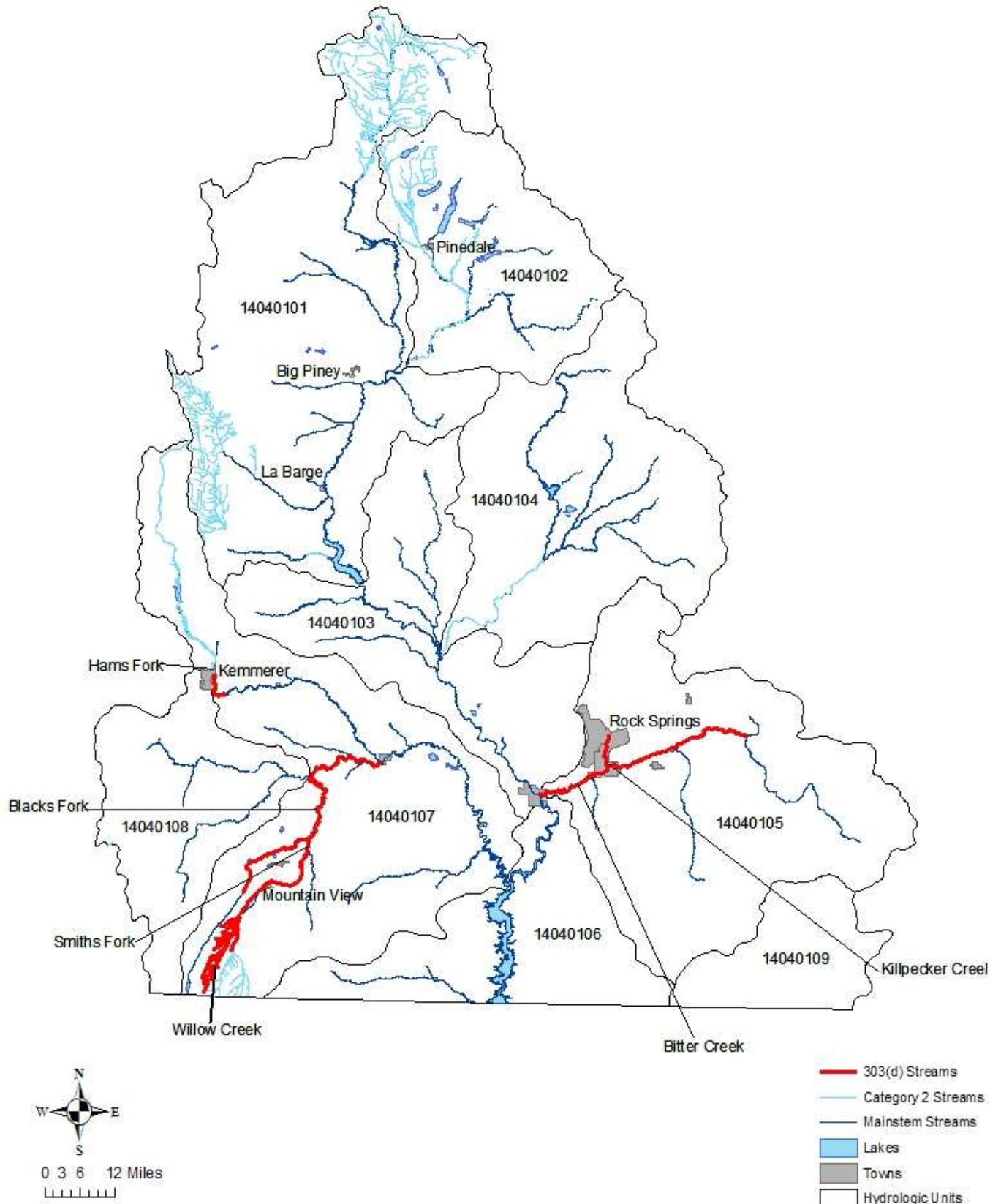
to identify all causes, and conducted a cleanup effort to prevent the contamination of Poison Creek and to protect aquatic life and wildlife. After the cleanup effort, DEQ monitored Poison Creek and has determined it is now supporting its aquatic life and wildlife uses, so it has been delisted from the 303(d) List.

Salt Creek, a tributary to Stockade Beaver Creek, was named for the natural brine springs which contribute a large salt load to Stockade Beaver Creek and the Cheyenne River basin. DEQ conducted monitoring on Beaver Creek and Stockade Beaver Creek, and is considering additional monitoring. The Cheyenne River in South Dakota below the confluence with Beaver Creek is listed as impaired on their 2006 303(d) list due to sediment, SAR, and high total dissolved solids, and TMDLs are being developed there. A source of any high TDS and sodium coming from Wyoming is likely from this Sub-basin, however there is nothing at this time which indicates the high TDS is not natural.

#### **Hat Creek Sub-basin (HUC 10120108)**

Primary land use in the Hat Creek Sub-basin is grazing. DEQ conducted a bioassessment of the Sage Creek watershed which suggests full aquatic life use support. Existing data and information also suggest that no significant water quality problems exist on Sage Creek.

# Green River Basin 2008



## **Green River Basin**

The Green River Basin is in the southern part of Wyoming. Snow melt runoff from higher elevations is the major water source for the Green River and most of its tributary systems. Almost all of these headwaters are in granitic or metamorphic rock and have some of the best quality water in the basin. Lower elevations have the least precipitation, and most streams originating there are intermittent or ephemeral. As streams flow through more arid lower elevations and the easily eroded sedimentary geologic materials found there, TDS values and sediment loads generally increase. Peak flows usually occur in May and June as snowmelt water moves through the basin, and sudden severe summer thunderstorms occasionally add to July and August flows. There are spring fed perennial reaches throughout the river basin.

Because the Green River is part of the Colorado River Compact of 1922, its waters are apportioned among the participating states. The Green River has the largest amount of unappropriated water in the state. It is the largest tributary of the Colorado River, and its waters are subject to salinity control through the Colorado River Basin Salinity Control Program. Although there are few salinity problems in Wyoming compared with the lower Colorado River Basin, it is often more economically feasible to reduce salinity in upper parts of the Colorado Basin. Because irrigated agriculture can contribute to salinity by percolation, evaporation, and return flows through shallow soils developed on saline geologic materials, major salinity control measures to reduce irrigation related salinity input to the Green River have been implemented in the Big Sandy and Flaming Gorge sub-basins.

Extensive natural salt deposits of trona (a sodium carbonate) were inferred from late 1890's well water quality. Trona deposits were investigated in the late 1930s. Mining began in the late 1940s and mining and prospecting continue today. Trona typically occurs with halite and gypsum. These Wyoming deposits are the world's largest natural source of trona. Coal deposits have also been mined in parts of the basin. Oil development began around 1920, and continues today. Natural gas is produced throughout much of the basin and is currently a booming industry. The primary agricultural land uses are grazing and irrigated hay production.

### **Upper Green Sub-basin (HUC 14040101)**

The Upper Green Sub-basin includes all tributaries into the Green River above Fontenelle Dam, except the New Fork Sub-basin. Fontenelle Reservoir is in the southern part of this sub-basin below LaBarge, Wyoming. It was constructed from 1961-64 and modified in 1984-86. Headwaters are in the Bridger-Teton National Forest, primarily in well indurated igneous and metamorphic geology. Lower elevation areas of the sub-basin lie in primarily fine grained sedimentary rocks which are a natural source of fine sediment and TDS in surface waters. Primary land uses are grazing, recreation, irrigated hay production, and oil and gas development.

Kendall Warm Spring is the only known habitat of the Kendall Warm Springs dace, a unique fish subspecies which is the only Wyoming fish currently listed (in 1980) under the Endangered Species Act. Its listing is not due to any water quality problems, but due to the naturally limited area in which it is found.

Dry Piney Creek is perennial in its headwaters and part of the main stem, but becomes non-perennial before its confluence with the Green River (WGFD, 2002). Results from DEQ monitoring conducted on Dry Piney Creek were inconclusive, so further monitoring will be conducted to determine use support. A gas processing facility, and oil and gas wells are located in the upper portions of the LaBarge Creek-Dry Piney Creek-South Piney Creek drainages. Concerns with oil seeps and ponds associated with oil wells, and physical degradation of the stream have been identified by DEQ. Seasonal dewatering of North Piney, Middle, and South Piney Creeks may limit potential aquatic life (WGFD, 2002; WGFD, 2004).

Extensive monitoring by DEQ in the watershed between Highway 191 and the Green River Lakes indicate that streams in this portion of the watershed are supporting their aquatic life uses.

Bioassessments conducted by DEQ on LaBarge and Fontenelle Creeks indicate that aquatic life uses are supported in the upper drainages within the Bridger-Teton National Forest, and in the lower mainstem of Fontenelle Creek, just above Fontenelle Reservoir. WGFD has removed non-native trout and is establishing a population of pure Colorado River cutthroat trout in the upper La Barge drainage. However, concerns have been identified by DEQ regarding physical degradation in parts of the lower La Barge Creek drainage, as well as seasonal dewatering due to irrigation withdrawal (WGFD, 2002). DEQ data collected on Rock Creek, a tributary to LaBarge Creek, indicate it was fully supporting its aquatic life uses. However, reported management changes raise concerns about current use support conditions.

### **New Fork Sub-basin (HUC 14040102)**

Headwaters of the New Fork Sub-basin are in granitic and metamorphic geologic materials in the Wind River Mountains. The headwaters area contains hundreds of lakes, a remnant of past glaciation. Water quality is reported as good in most of the upper watersheds, however full use attainment monitoring has not been conducted. Geologic materials in the lower sub-basin include fine to coarse grained sedimentary rocks and are a natural source of fine sediment and TDS. Land uses in the sub-basin include recreation, forestry, grazing, irrigated hay production, and oil and gas development. Limited uranium exploration was carried out in the Pinedale area.

Extensive natural gas development has been occurring in the Pinedale Anticline area of this watershed. One of the outcomes of the BLM's Pinedale Anticline EIS Record of Decision was the need for an expanded ground- and surface water monitoring network in the Pinedale Anticline Project Area (PAPA). The operator has hired the Sublette County Conservation District (Sublette CCD) to conduct the surface monitoring for this project. Sublette CCD incorporated this monitoring program into their existing surface water monitoring network. Chemical and biological monitoring began in 2001 at three locations on the New Fork River. Sublette CCD began reporting monitoring results to the Pinedale Anticline Working Group that same year. The project was expanded to 4 sites in 2004, 5 sites in 2006 and 8 New Fork River sites in 2007. Monitoring conclusions suggest the overall ecological condition of the New Fork River is not significantly different from expected values as defined by the baseline study (Marshall, 2007).

Bioassessments conducted by DEQ in the watershed between Highway 191 and the New Fork Lakes indicate that this portion of the watershed is supporting its aquatic life uses.

### **Slate Creek Sub-basin (HUC 14040103)**

Slate Creek Sub-basin includes the Green River and its tributaries, other than the Big Sandy River, below Fontenelle Reservoir and above Bitter Creek, near Rock Springs. Geologic materials include sandstone, mudstone, limestone, oil shale, and conglomerate. Soils developed in these materials tend to be saline and alkaline, erode easily, and can be very difficult to stabilize after being disturbed. Many streams are intermittent or ephemeral and water quality is usually similar to basin streams derived in this type of geology. The Seedskaadee National Wildlife Refuge lies along the Green River below Fontenelle Reservoir. This refuge supports a unique population of waterfowl and is an important recreational fishery. Land uses include grazing, oil and gas development, and trona mining and processing. Oil and gas production began in the early 1900s and continues today.

In August of 2007 the DEQ and WGFD investigated two fish kills in the Green River in this sub-basin. The first fish kill was in the vicinity of the City of Green River. The investigation determined the cause of the fish kill to be from the aerial application of malathion insecticide. The second fish kill was first observed on August

14, 2007 in the immediate vicinity of Slate Creek immediately downstream of Fontenelle dam. WGFD investigation identified several hundred mountain whitefish and a limited number of juvenile trout dead. Numerous other trout and minnow species were observed alive and behaving normally in this reach. DEQ investigated the site on August 16<sup>th</sup> and collected samples for TDS, TDS, total petroleum hydrocarbons (TPH) (DRO), DO, pH, temperature, and conductivity at three locations within the reach. Monitoring results did not identify any unusual values with the exceptions of: 1) the field temperatures at all three locations (23.9, 24.6, and 24.9) were greater than the 20°C criterion for cold water game fish; and 2) pH values (8.70, 8.72, and 8.90) appeared higher than what would be expected for this reach. Blue-green algae blooms were noted on Fontenelle Reservoir in September 2007. Even though Bureau of Reclamation tests on the algae did not indicate the formation of toxins, the situation does indicate nutrients and water temperatures are sufficient to result in these blooms. Algal blooms along with temperature and pH data collected at the time of the fish kill may suggest a system where extreme diurnal oxygen swings are resulting in critically low DO levels at night. WGF collected a number of fish for necropsies. Those results were not available for this report.

### **Big Sandy Sub-basin (HUC 14040104)**

Headwaters of the Big Sandy Sub-basin are in the granitic rocks of the southern Wind River Range. Because of this geology, much of the substrate in the streams is coarse sand derived from decomposed granite. Land uses in the Big Sandy Sub-basin are primarily grazing, irrigated hay production, recreation, and oil and gas development.

Water is diverted from the Big Sandy River below Big Sandy Reservoir to irrigate lands in the Eden Project. Irrigation seepage into shallow aquifers has created saline seeps and springs below the Eden Project, which contributed about 149,180 tons of salt annually into the Green River (SCS, 1987). The USDA Big Sandy River Unit Plan, published in 1988, consists of converting 15,700 acres of surface irrigation to low-pressure sprinkler irrigation to reduce salt loading by approximately 52,900 tons per year (CRBSCF, 2002). This program is being managed through the NRCS, and has converted 10,790 acres of irrigated lands to date, which has resulted in a salt load reduction of 42,319 tons per year. Effects of the salinity reduction on streams in the Big Sandy and Green River drainages have not been determined, however crop production and water savings have reportedly increased where irrigation conversion has occurred (SWCCD, 2004).

Several riparian exclosures were created in the 1980s to protect parts of the riparian area along the Big Sandy River, between Little Sandy Creek and the Green River, and to enhance fish habitat. Rock sill structures have been built in Big Sandy River and in Bone Draw with the goals of raising the water table, increasing riparian vegetation, providing habitat for juvenile fish, and improving channel conditions. Erosion, unstable banks, and lack of woody riparian vegetation have been identified as problems in this reach of the Big Sandy River. The primary sources of these problems are thought to be due to changes in flow regime since the construction of Big Sandy Reservoir, and to the partial conversion from sheep grazing to cattle grazing, which changes the utilization of vegetation. The Big Sandy Working Group (BSWG), comprised of the BLM, grazing permittees, WGFD, Trout Unlimited, Sweetwater County Conservation District (then Big Sandy CD), other stakeholders, and a facilitator, was formed in 1996 to address these problems. BSWG developed a 10 year goal and a 50 year vision statement that identified some of the trends the river corridor should follow. In order to meet these goals, the allotment management plans for the four allotments that use this reach of the Big Sandy River have been changed. Some of these changes include: modification of grazing rotation, allotment boundaries and season of use; installation of electric fencing; development of upland water sources, and; implementing the monitoring plan developed by BSWG (BLM-GR, 2003).

Despite the riparian and bank stability problems, assessments conducted by DEQ in 1998 indicate that aquatic life uses are supported on the Big Sandy River, between the Green River and the confluence with Little Sandy Creek.

Monitoring conducted by DEQ on Little Sandy Creek has identified areas of habitat degradation and streambank instability. Those conditions have also been identified in BLM data. The BLM and grazing permittees are cooperatively working to modify grazing practices along portions of Little Sandy Creek to improve the riparian and stream habitat. These modifications include installation of electric fencing and rotation of stock through the allotment so riparian areas are only grazed once per season (BLM-GR, 2002). DEQ has been monitoring annually to quantitatively track improvements in habitat quality and bank stability.

### **Bitter Creek Sub-basin (HUC 14040105)**

The Bitter Creek Sub-basin lies entirely within sedimentary basin geology, composed of mostly fine grained sedimentary rocks containing salts and other evaporite minerals. Because of the arid climate and relatively low elevation and basin terrain, most reaches in this drainage are non-perennial. Snowmelt and occasional rainstorm events often transport high loads of sediment and dissolved salts. Land uses include grazing, coal mining, phosphate mining, uranium exploration, and oil and gas development.

Bitter Creek, a tributary to the Green River, drains a large arid area in the eastern portion of the sub-basin, including a western fringe area of the Red Desert basin. Bitter Creek is classified as a non-game fishery (Class 2C). Monitoring conducted by DEQ in 1998 on Bitter Creek near Rock Springs and a tributary, Killpecker Creek (confluence with Bitter Creek in Rock Springs), identified two water quality problems. Both these streams are impaired for recreational use due to elevated fecal bacteria counts. Chloride samples collected by DEQ also indicate that Bitter Creek from Rock Springs downstream is impaired for its non-game fishery use due to chloride concentrations well above the acute criterion of 860 mg/L. During sampling in 1998, a fish kill was noted on Bitter Creek below Killpecker Creek, which may be related to the very high chloride concentrations recorded. Killpecker Creek is a significant source of chloride to Bitter Creek, but as a Class 3B water, it does not have a chloride criterion. Diurnal oxygen fluctuations and habitat degradation are also concerns on these streams.

A 319 watershed project administered by the Sweetwater County Conservation District (SWCCD) investigated the problems and concerns on these waters. Data from that project indicate the *E. coli* exceedences in Bitter Creek have been detected well upstream of Rock Springs during higher flow events, suggesting a primarily non-point source of bacteria in the upper watershed. Additionally, the impairment on Killpecker creek extends from Reliance downstream to the confluence with Bitter Creek. The SWCCD study suggests possible source of *E. coli* in lower Bitter and Killpecker Creeks may be septic system contamination, urban runoff, including animal sources, and leaking sewage lines in contact with groundwater that surfaces into the creeks. Chloride data collected from Bitter Creek show exceedences of the chronic chloride criterion (230 mg/L) from Point of Rocks downstream to the confluence with Killpecker Creek, and exceedences of the acute criterion from Killpecker Creek down to the Green River. The primary source of the high chloride is likely from the geology and soils of the watershed, especially the Killpecker Creek watershed. Surface application and infiltration of large amounts of irrigation water for turf grasses at recreational facilities adjacent to Killpecker Creek may be dissolving and transporting salts from the alluvium and colluvium into the creek. A watershed plan for Bitter and Killpecker Creeks, sponsored by the Bitter Killpecker Creek Watershed Advisory Group and SWCCD was approved in 2007.

### **Flaming Gorge Sub-basin (HUC 14040106)**

The Flaming Gorge Sub-basin includes all the tributaries to the Green River and Flaming Gorge Reservoir below Bitter Creek and above the confluence with Vermillion Creek (in Colorado), except the Blacks Fork. Flaming Gorge Reservoir, built in 1958-64 and modified in 1978 and 1984, and the Flaming Gorge National Recreation Area are within this sub-basin although the dam itself is in Utah. The Green River and the Black's

Fork flow directly into the upper part of the reservoir; the Henry's Fork flows into the lower part of the reservoir in Utah. Most of the sub-basin consists of fine grained sedimentary rocks, many of which are easily eroded and contain large amounts of evaporite minerals. Land uses include grazing, irrigated agriculture (mostly in the Henry's Fork drainage), recreation, and oil and gas production.

The Little Mountain Watershed Enhancement project was initiated in 1990 because of concerns with declining Colorado River Cutthroat trout populations due to deteriorated stream habitat conditions, and concerns with the mule deer population. This project is sponsored by WGFD, BLM, landowners, and a number of organizations, and is designed to restore watershed function and decrease eutrophication of Flaming Gorge Reservoir via modification of grazing management, prescribed burns, re-introduction of beaver, and other measures. The project currently includes Currant Creek and parts of the Trout, Sage, and Red Creek watersheds, and has shown marked improvement of both riparian and upland areas, and increases in perennial flows.

### **Blacks Fork Sub-basin (HUC 14040107)**

Headwaters of the Blacks Fork Sub-basin are in the Uinta Mountains in northeastern Utah, and the Tump and Wyoming Ranges in Wyoming. The Black's Fork flows in a loop through the Bridger Basin before flowing into the upper part of Flaming Gorge Reservoir. Major tributaries include the Smiths Fork which also headwaters in Utah, and the Hams Fork, which drains from the north. Muddy Creek is another tributary, but its sub-basin (HUC 14040108, discussed below) is not included in the Black's Fork Sub-basin. Land uses in this sub-basin include grazing, irrigated hay production, trona and coal mining, and oil and gas production.

The Hams Fork near Diamondville was listed on the 1998 303(d) list due to high pH (above the criteria of 9.0 standard units) measurements indicating it is partially impaired for its aquatic life uses below the Town of Kemmerer. The elevated pH is thought to be due primarily to excessive photosynthetic activity, in naturally high pH waters, from nutrient enrichment below the Kemmerer-Diamondville WWTF. Nutrient enrichment can also result in very low dissolved oxygen concentrations when photosynthesis is not occurring. The Kemmerer-Diamondville Joint Powers Board has committed to monitoring the river above and below their discharge location, and will be cooperatively monitoring with Lincoln Conservation District. WYPDES permit modifications are likely when the permit comes up for renewal in 2008. The Hams Fork is a class 2AB water; however, the impairment does not represent a risk to human health. Development of a TMDL for the Hams Fork will begin in 2008 and a TMDL is expected in 2009.

The lower Blacks Fork, from its confluence with the Hams Fork upstream to an undetermined point above the Smiths Fork, is listed on the 303(d) List for impairment of contact recreation uses. Uinta County Conservation District (UCCD) has monitored water quality at 12 sites on the Blacks Fork as part of a Section 319 assessment grant. Data from that project did not show any exceedences of the *E. coli* criterion below the Smiths Fork, but did determine the impairment extended upstream to Millburne. Therefore, the 303(d) listed reach has been extended. The sources of *E. coli* contamination remain unknown at this time. The Black's Fork below the Hams Fork has been monitored, but the results are inconclusive regarding aquatic life use support. The Blacks Fork is currently contained within the approved Blacks Fork and Smiths Fork Rivers Watershed Management Plan sponsored by UCCD.

The Smiths Fork from the confluence with the Black's Fork upstream an undetermined distance is on the 303(d) List because monitoring conducted by DEQ, showed the stream was not meeting its use for contact recreation. UCCD has monitored water quality at 5 locations on the main stem of the Smiths Fork as part of their 319 project which show the impairment extends from the Blacks Fork up to East and West Smiths Forks. Older data indicate East and West Smiths Forks may also exceed the *E. coli* criterion, however, because of grazing management changes on East and West Smiths Forks and the absence of more recent monitoring data, they will not be placed on the 303(d) list. If they are found to be a significant source of *E. coli* to the Smiths Fork during TMDL development or watershed planning, that issue will be addressed concurrently. The Smiths Fork is also

covered under the watershed management plan sponsored by UCCD.

The East and West Fork of Smiths Fork, and Willow Creek above the Black's Fork, were placed on the 1998 303(d) List due to threats of aquatic life use support due to physical degradation of the stream channels. UCCD completed a 319 watershed improvement project in 1999 to improve the physical condition of the stream channels and riparian areas. Data submitted by UCCD were not sufficient to determine use support, but indicated improvement of the habitat in these streams (UCCD, 2001). DEQ monitored these streams in 2003, and that monitoring also showed habitat improvement. Data indicate both East and West Forks of Smiths Fork fully support their aquatic life uses, and they were removed from the 303(d) List. However, data collected on Willow Creek in 2003 showed high temperatures and pH, and a degraded biological community in the lower reach. These conditions contrast with the noted improvements in riparian habitat and management. The lower scoring data are possibly related to the drought, but definitive use support at this time is unclear. DEQ plans to allow several years for stream health to recover before conducting further monitoring. Willow Creek remains on the 303(d) List.

The TMDL development process is scheduled to begin in 2009 for *E. coli* on the Blacks Fork and Smiths Fork, and for physical habitat on the Smiths Fork and Willow Creek. Completion of the TMDLs is expected by 2011.

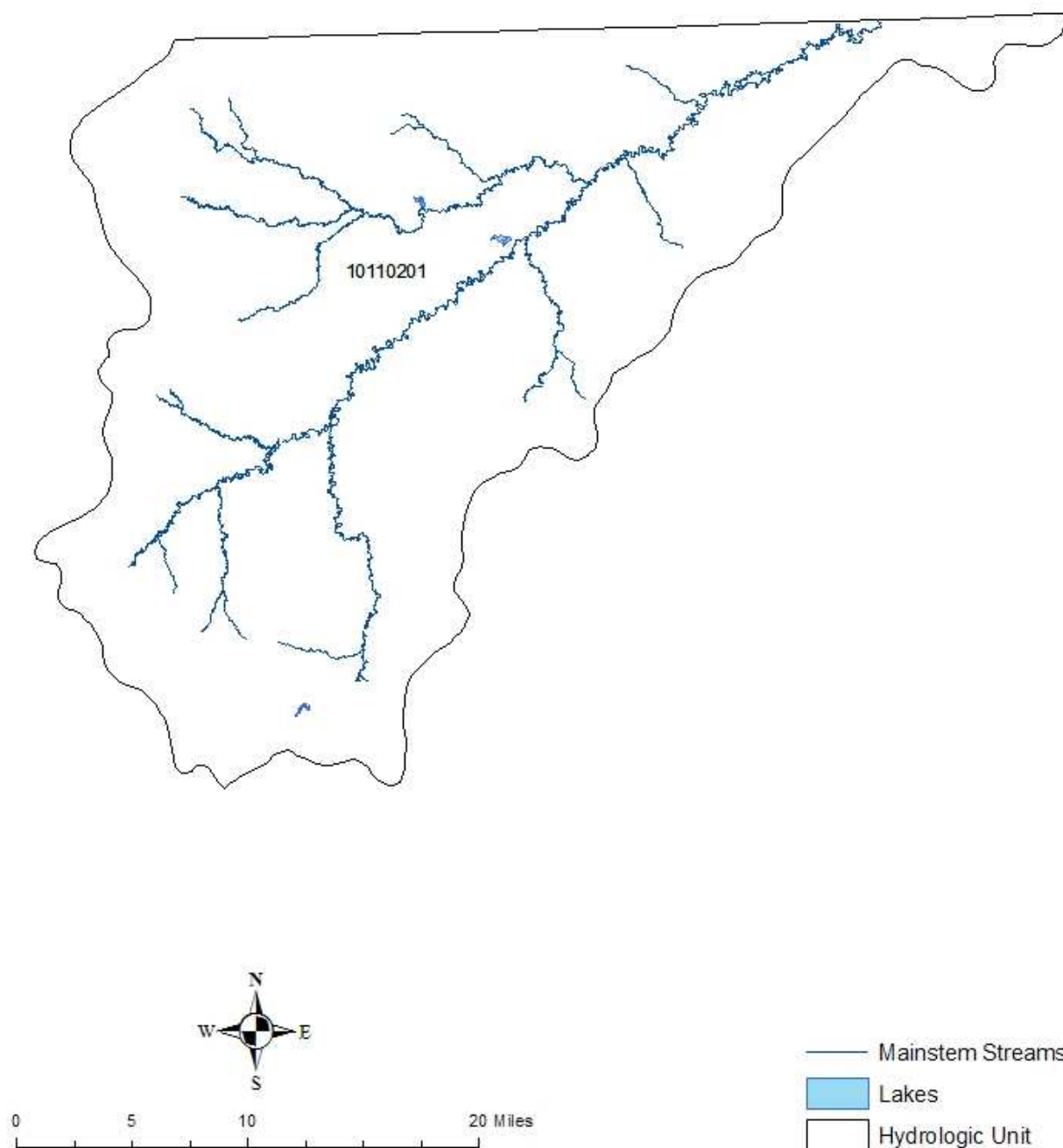
#### **Muddy Creek Sub-basin (HUC 14040108)**

Muddy Creek Sub-basin drains the east slope of the Bear River Divide, north of Evanston, and Oyster Ridge, south of Kemmerer, and then flows into the Black's Fork of the Green River. Soils in this sub-basin were developed from shale and sandstone geologic materials, with added windblown sand. These arid soils tend to have high carbonate content and are usually easily eroded by wind or water. The Oyster Ridge area has been mined for coal at least since the early 1900's and is the site of the historic Cumberland Mining District. Land uses include grazing, some irrigated hay production, oil and gas development and production, and historic and current coal mining.

#### **Vermillion Sub-basin (HUC 14040109)**

The Vermillion Sub-basin drains a portion of the southern Red Desert before flowing into Colorado and the Green River. The primary land uses are grazing, and oil and gas development. Perennial reaches in this sub-basin include portions of the main stem of Vermillion Creek, the main stems of Coyote Creek and Canyon Creek. Vermillion Creek drains into the Green River in Colorado and contributes a TDS load of mostly sulfate and sodium from the area's geologic materials. In the Vermillion Creek and Coyote Creek watershed, BLM, WGFD, landowners, permittees, and the National and Wyoming Wildlife Federation are cooperating in an allotment management plan, which is reducing sediment loads and improving riparian areas. DEQ conducted assessment work in the Vermillion Sub-basin in 1998. Those data were inconclusive and the watershed was revisited in 2003. The results of the most recent assessment are not finalized at this time.

**Little Missouri River Basin  
2008**



## **Little Missouri River Basin**

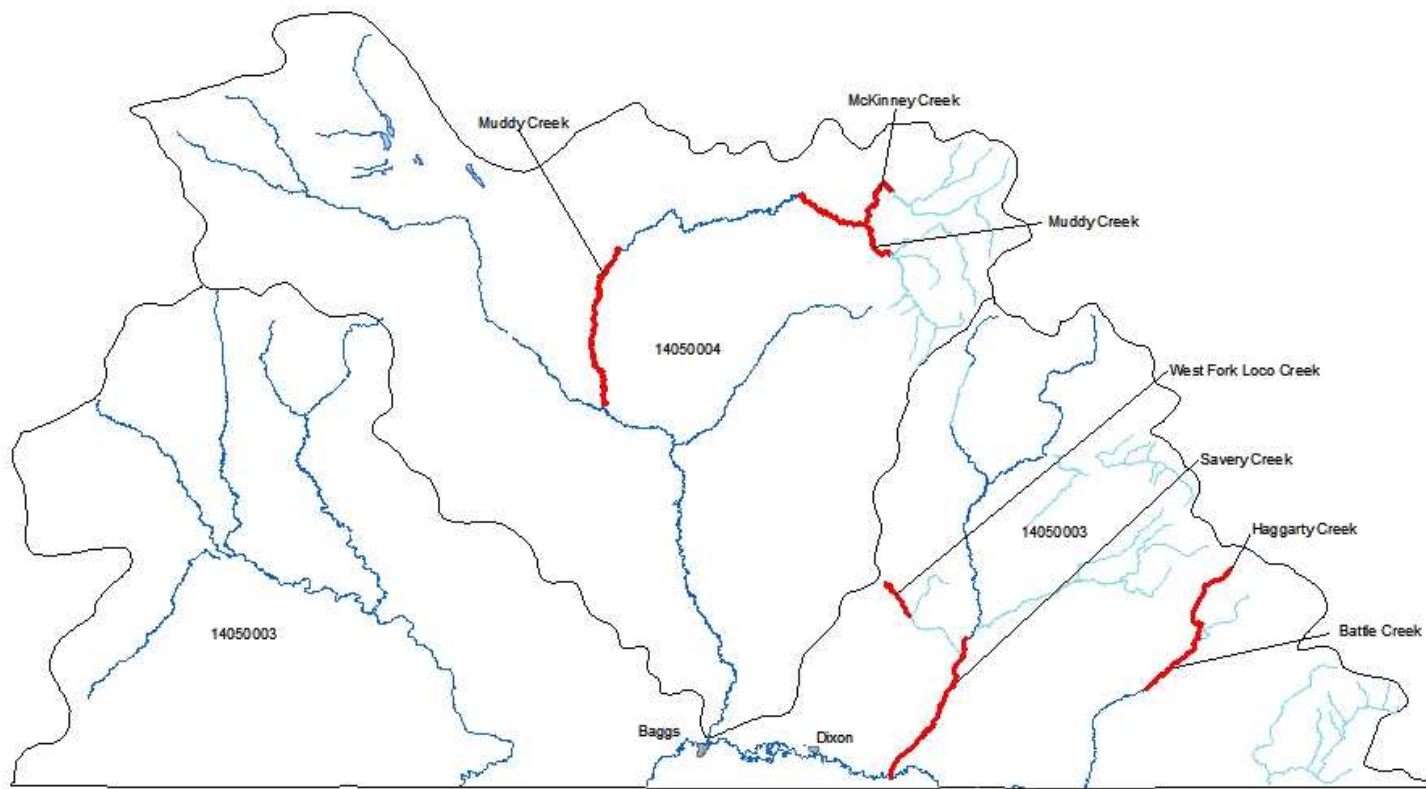
The Little Missouri Basin in Wyoming includes only one defined sub-basin (HUC 10110201). Land uses include grazing, farming (both dryland and irrigated), bentonite mining in the lower drainages, and oil production in the upper drainages. Concerns with siltation and flow alteration in the Little Missouri and the North Fork of the Little Missouri were identified by Devils Tower Conservation District (now Crook County Natural Resource District). However, bentonitic clays often remain suspended in water, and a certain degree of turbidity is natural. Stream flow is often intermittent, however, water generally remains in pools, even during dry periods. Many of the ephemeral tributaries in this sub-basin have been dammed by earth berm dams. Approximately 500 acres of abandoned bentonite mine lands have been reclaimed by AML in the sub-basin. Bentonite companies continue to mine and reclaim land in this area.

### **Little Missouri Sub-basin (HUC 10110201)**

A large wetland complex is being developed on the North Fork of the Little Missouri River, at the site of a large breached earthen dam. This project is expected to improve both wildlife and aquatic habitat.

DEQ collected monitoring data in the basin in 2002, however results were inconclusive.

# Little Snake River Basin 2008





## **Little Snake River Basin**

The Little Snake River Basin is bordered on the east by the Continental Divide along the Sierra Madre Mountains, the north by the Great Divide Basin, and to the west by the Green River Basin. The Little Snake River is a tributary to the Yampa River, in the Green and Colorado River System. The Sierra Madre Range is primarily composed of Precambrian igneous and metamorphic rocks which are relatively resistant to erosion. However, in the lower elevations the geology consists of mostly fine grained sedimentary rocks, most of which are easily eroded and often contain high levels of various salts.

### **Little Snake Sub-basin (HUC 14050003)**

Haggarty Creek originates near the Continental Divide and confluent with Lost Creek to form West Fork Battle Creek. Monitoring on Lost Creek by DEQ indicates it fully supports its aquatic life uses. Haggarty Creek receives discharges from an inactive copper mine, the Ferris-Haggarty/Osceola Tunnel, which dates from 1898. Haggarty Creek has been on past 303(d) lists due to metal exceedences (primarily copper with less toxic amounts of silver and cadmium) discharging from the Ferris-Haggarty Mine. The Department of Environmental Quality - Abandoned Mine Lands (AML) Program funded a pilot project to treat some the effluent. However, it is not economically feasible to remove 100% of the copper from all the effluent because land is not available to place a large treatment facility. AML is presently working on a proposal to plug the upper shaft above the mine tunnel. This could potentially reduce the volume of discharge from the mine and water quality to support fish could improve in much of the stream. Copper criteria are also exceeded on the West Fork of Battle Creek, downstream of Haggarty Creek, so this stream is also the 303(d) List. TMDLs for these listed pollutants are expected to be completed in 2008.

Monitoring in the Little Snake watershed indicates that aquatic life uses are fully supported in Dirtyman Fork, Loco Creek and the portions of Savery Creek and North Fork Little Snake drainages within the National Forest and much of the upper watershed of Little Savery Creek. However, physical degradation of lower Savery Creek and West Loco Creek is considered threatening full aquatic life use support, and these streams are on the 303(d) List. Recently, a 319 watershed improvement project was completed by Little Snake River Conservation District (LSRCD) however final data was not submitted in time to be analyzed for this report. DEQ recognizes the restoration activities conducted Savery Creek watershed, and will review LSRCD data to determine if the threats have been mitigated and these waters warrant delisting.

### **Muddy Creek Sub-basin (HUC 14050004)**

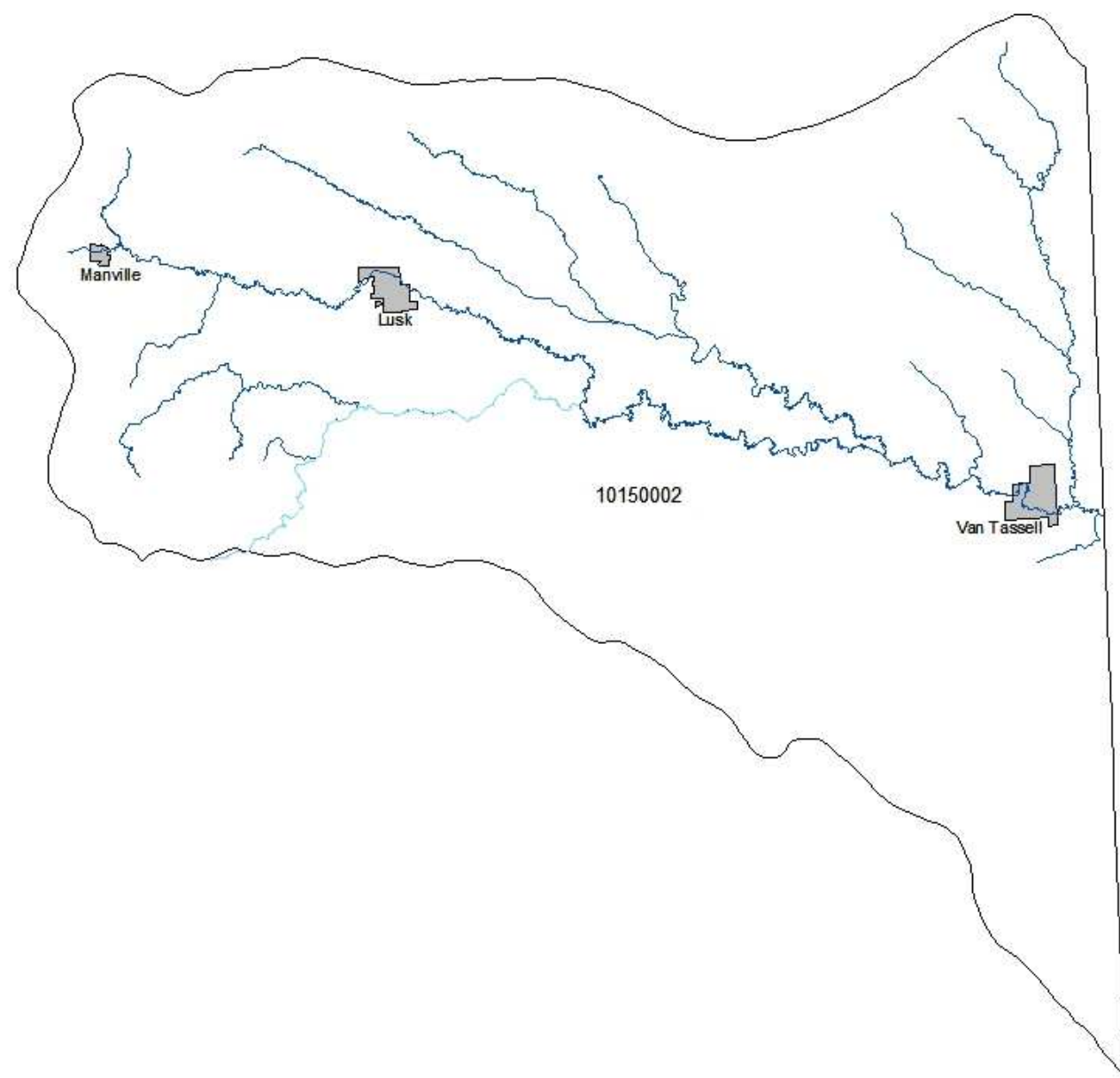
The Muddy Creek Sub-basin includes all the tributaries to Muddy Creek, which flows into the Little Snake River at Baggs. Unstable stream channels and loss of riparian function have been a problem in much of the sub-basin. In the upper Muddy Creek watershed, LSRCD, BLM, landowners, grazing permittees, WGFD, and other stakeholders have been involved in a Coordinated Resource Management (CRM) process since 1992 to address these water quality and riparian habitat problems. As part of the CRM process, LSRCD has managed several 319 watershed improvement projects in the Upper Muddy Creek drainage. Implementation measures include upland water development, cross fencing, vegetation management and grazing management, while maintaining livestock numbers. Other watershed function restoration has been implemented in the Grizzly Wildlife Habitat Management Area (WHMA), which includes the upper Littlefield Creek drainage and other portions of the upper Muddy Creek drainage. In the Grizzly WHMA, WGFD has been working with the BLM, the grazing permittee, and LSRCD to implement similar measures, however, the primary grazing strategy is to defer grazing for several years to allow better willow re-establishment. Data collected by LSRCD and WGFD indicate that implementation measures and management changes in both these projects have resulted in considerable improvement to stream stability, aquatic habitat, and riparian areas, especially in the upper Muddy Creek tributaries. Data collected by LSRCD show that Muddy Creek and Littlefield Creek above their

confluence, and McKinney Creek above Eagle Creek are meeting their aquatic life uses, and these reaches were removed from Table C of the 303(d) List in 2000. Colorado River Cutthroat trout have been re-introduced into their former habitat in Littlefield Creek, and are planned to be re-introduced into Muddy Creek, above McKinney Creek. Muddy Creek below Littlefield Creek and McKinney Creek below Eagle Creek are listed on the 303(d) List because physical degradation of the stream channels and riparian areas were still considered threats to aquatic life uses. Initial review of data collected by LSRCD suggests full aquatic life use support, however final data was not submitted in time to be fully analyzed for this report.

Another project was implemented by LSRCD and other stakeholders on the reach of Muddy Creek, lying west of Highway 789, to address physical degradation of the stream channel, which threatens its aquatic life use support. This reach of Muddy Creek is also on the 303(d) List. Implementation measures include wetland development, re-establishment of the floodplain and irrigation water management. Results of this project show an improving trend in riparian condition and bank stability above Red Wash. Initial review of data collected by LSRCD suggests full aquatic life use support, however final data was not submitted in time to be analyzed for this report. However, habitat degradation has been identified by the BLM and LSRCD as a serious water quality concern on Muddy Creek, from Red Wash downstream to the Little Snake River. The habitat degradation is likely caused by season long riparian grazing, exacerbated by accelerated erosion associated with oil and gas activities. Several grazing management Best Management Practices (BMPs) are being implemented in much of this lower watershed, including changes in length, timing and duration of grazing, and cross fencing. However, projected increases in coal bed methane development have the potential to lead to increased surface disturbance and possible increased erosion and sediment loading.

DEQ recognizes the restoration activities conducted in the Muddy Creek watershed, and will review LSRCD data to determine if the threats have been mitigated and these waters warrant delisting.

# Niobrara River Basin 2008



0 2.5 5 10 Miles

- 303(d) Streams
- Category 2 Streams
- Mainstem Streams
- Lakes
- Towns
- Hydrologic Units

## **Niobrara River Basin**

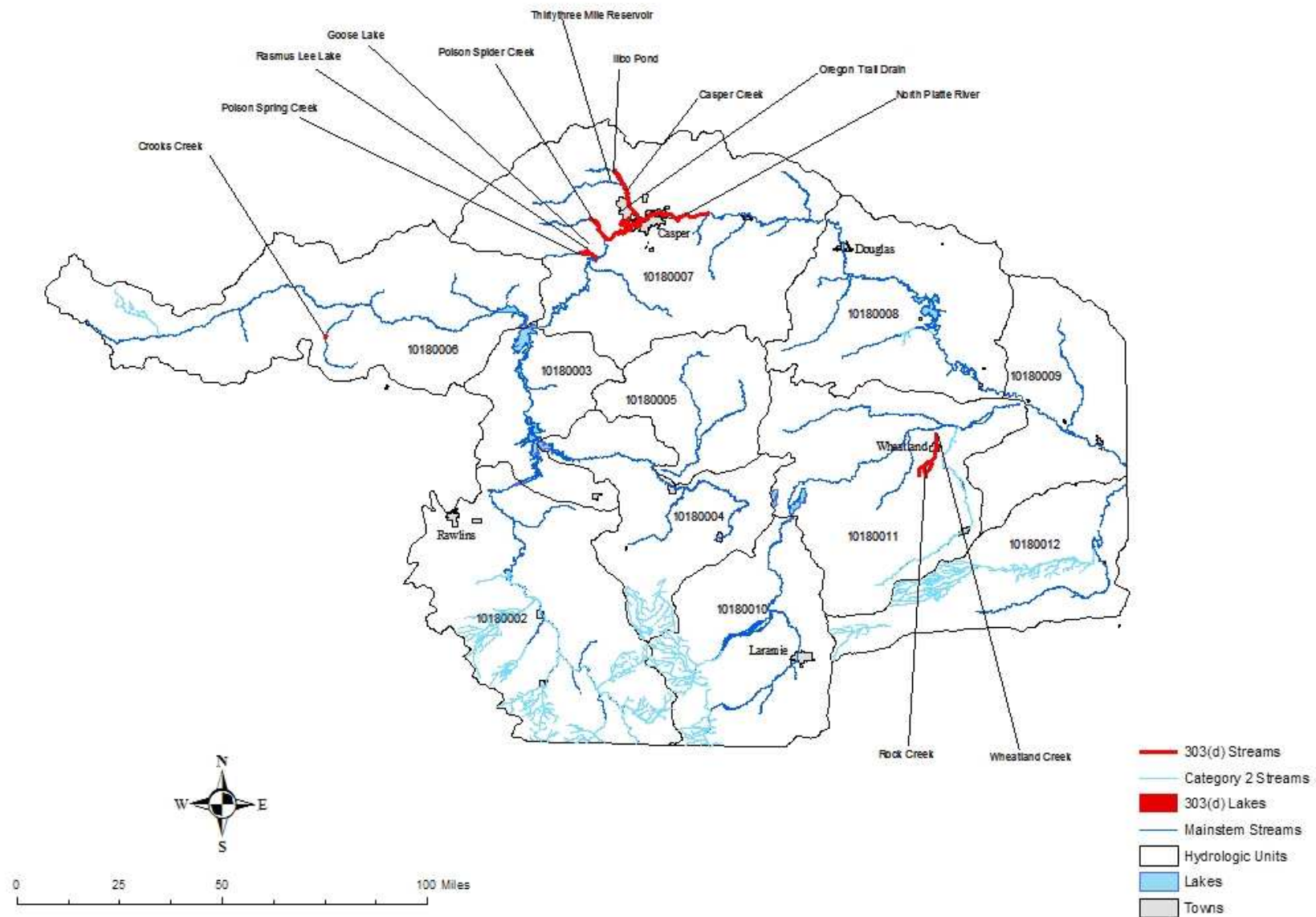
The Niobrara Headwaters Sub-basin is the only sub-basin in the Niobrara River Basin in Wyoming. Land uses are primarily grazing, with dryland and sprinkler irrigated crop and hay production. Sandy soils essentially prohibit flood irrigation and limit surface flow in streams.

### **Niobrara Headwaters Sub-basin (HUC 10150002)**

Flows in a large stretch of the Niobrara River below Lusk apparently never flow above ground, even during recent catastrophic flooding upstream. The river channel is an undefined grassy swale. Further downstream flows surface and form an extremely slow moving, wetland-like stream, choked with bull rushes and cattails. Historical reports by local residents indicate that in the 1930s the lower stream channel was more defined and supported a population of trout. However, at that time, it appears that the Niobrara River had higher flows than today. The WGFD manages the Niobrara River and Van Tassel Creek for native non-game fish.

Silver Springs Creek, a tributary to the Niobrara River, is a Class 3B water. Silver Springs Creek only has perennial to intermittent flows in an approximately three mile reach from its headwaters downstream to about one half mile below Silver Springs. There are numerous springs in this reach which provide most of the flow except during snowmelt and rainfall events. The stream channel consists of numerous pools which can become isolated during drier periods. Below this reach, the flow regime is entirely ephemeral and the stream channel consists of a grassy swale. Niobrara CCD monitored this watershed from 2001 through 2007. Evaluation of benthic macroinvertebrate data indicates a biological condition similar to reference condition for a spring fed stream with predominantly lotic habitat. Additionally their data show a naturally reproducing population of several species of nongame fish, suggesting the upper reach should be classified as a Class 2C water. Based on the weight-of-evidence of all available data, it appears that Silver Springs Creek is fully supporting its Class 3B aquatic life use, as well as a non-game fishery use in the upper perennial/intermittent area.

# North Platte River Basin 2008



## **North Platte River Basin**

The North Platte River originates in North Park in Colorado and flows into Wyoming from the south. Major tributaries in Wyoming include the Encampment, Medicine Bow, Sweetwater, and Laramie Rivers. Because the North Platte River is dammed seven times before it enters Nebraska, both its flow regime and water quality characteristics have been significantly changed from its natural state.

All available water (under a US Supreme Court decree governing water use) within the North Platte drainage in Wyoming is allocated for beneficial use. Like the other rivers in the state, most of the allocated water is used for irrigation.

Trout never existed in the North Platte drainage until they were first stocked in the middle 1800's and now many areas in the basin are famous for their trout fishing opportunities. Walleye, the other principal game fish in the basin, have been stocked in Glendo Reservoir and several other smaller reservoirs. They are now abundant in all the mainstem reservoirs and many off-mainstem reservoirs within the basin.

### **Upper North Platte Sub-basin (HUC 10180002)**

The Upper North Platte Sub-basin is that area upstream of Seminoe Reservoir to the Colorado Line. Like most of the high elevation basins in Wyoming, most of the bottom lands are privately owned and irrigated for hay production. Generally, the uplands are grazed at lower elevations primarily early and late in the year, and the higher elevations are grazed in the summer.

Logging occurs mostly on Medicine Bow National Forest lands, and much of the forested area was historically harvested for railroad ties. Many of the larger mountain streams were straightened and had logs and boulders removed to facilitate tie driving.

There is some oil and gas production in the sub-basin, and Sinclair has an oil refinery. There are no large scale mining operations, but historically there has been considerable gold and copper mining in both the Sierra Madre and Medicine Bow mountains. DEQ's Abandoned Mine Lands Division (AML) has funded restoration projects in many of the mining areas within the sub-basin. Iron oxide was mined near Rawlins for use primarily as a paint pigment and has been applied on barns across the country. There has also been some limited coal mining in this basin, and gravel mines are scattered throughout.

Stream bank modification within the town limits of Saratoga, intended to reduce flooding, resulted in increased erosion in several other places as the river adjusted its channel. However, recent stabilization has been conducted with natural river processes in mind, which should reduce erosion. Natural hot springs in and near Saratoga slightly increase the temperature and dissolved solids content of the river. DEQ has conducted extensive monitoring on the mainstem of the North Platte River above Sage Creek and data indicates full support of aquatic life uses. However, there are reports that nutrient and sediment loads from Colorado may be increasing (WGFD, 2002). Monitoring of the reach above Seminoe Reservoir was conducted in 2002. Because there is not a comparable reference stream, aquatic life use support is inconclusive.

Tie driving probably occurred for a longer period of time on Douglas Creek than any stream in the state, continuing from the late 1860s until 1940, when the Union Pacific stopped the use of hand hewn, river driven ties. Devils Gate Creek was too steep and rocky to drive ties, so an extensive flume was built to carry ties and logs to Douglas Creek. Another impact in the Douglas Creek drainage was mining. Placer gold was first discovered near Keystone in 1868 and by 1870 hardrock ore bodies were also discovered and mined. Most gold

production ceased by the 1890s, but copper was mined between 1900 and 1918. Today, a number of gold dredgers still operate in the watershed above the Platte River Wilderness boundary. Rob Roy Reservoir was completed in 1965 to regulate flows in Douglas Creek, where water is diverted via a pipeline to Lake Owen in the Upper Laramie River Sub-basin before it is piped further east to be used for a portion of Cheyenne's water supply. Since all the water is allocated in the drainage, water is simultaneously diverted from the Little Snake drainage into the Encampment River drainage to replenish water taken from the North Platte Drainage. Fish habitat structures, primarily tree revetments, have been installed in Douglas Creek to improve aquatic habitat. Because of past mining, heavy metals were of concern in Rob Roy Reservoir, but monitoring conducted by United States Geological Survey (USGS) and the Cheyenne Board of Public Utilities as part of a 205j grant did not detect any high metal levels of concern for drinking water. Much of the lower watershed is in the Platte River Wilderness area, designated in 1984. Despite historic impacts to Douglas Creek, the reach within the wilderness has been monitored and assessed by DEQ as fully supporting its aquatic life uses as a cold water fishery and Class 1 water. Dredging and roads have been identified by the Forest Service as water quality concerns on Douglas Creek below Rob Roy Reservoir and above the wilderness boundary (MBRNF, 2003).

The watershed of Pelton Creek, which flows into Douglas Creek near the wilderness boundary, has been used as an example by the Forest Service of how good grazing management can improve water quality.

Based on Forest Service reports, impacts from historic mining are a concern on Bear Creek. DEQ has monitored this stream, but more metals data are needed to make a use support decision.

Roads and dredging were identified as water quality concerns on Smith North Creek, however monitoring conducted by DEQ indicates full aquatic life use support.

Much of the Muddy Creek drainage was cut for ties in the 1930s and remnants of an old splash dam for driving ties are still evident in the upper meadow. A road along most of the drainage was of concern and DEQ monitored and assessed the stream in 1998. Although a couple of road crossings contribute some sediment to the stream, their impacts are minimal and isolated, and the data indicates the stream meets its designated aquatic life uses as a Class 2AB water.

Much of the Cottonwood, Savage Run, and Mullen Creek Drainages lie within the Savage Run Wilderness Area. Although considerable timber harvesting has occurred in the drainages (both outside the wilderness and inside the present boundary prior to its designation in 1978) much of these drainages exhibit good riparian and streambank condition, based on observations by a DEQ biologist. Existing data and information do not suggest any water quality problems.

French Creek, Brush Creek, and Pass Creek were all modified to some extent for tie driving in the 1800s, and timber has also been recently harvested in these drainages, creating a fairly large network of roads. Much of the lower watersheds are irrigated via diversions from the streams. However, based on monitoring DEQ has conducted in the French Creek drainage, impacts from these sources, as well as historical placer and hard rock mining, do not appear to be affecting water quality. According to the Forest Service, streambank condition on Fish Creek, a tributary to North Brush Creek, is thought to have been impacted somewhat by season-long grazing, but a new grazing plan to reduce time of use intends to correct those impacts (MBRNF, 2004).

A large stakeholder driven watershed project was recently completed in the Cedar Creek drainage to address erosion problems from prior irrigation water delivery. North Brush Creek, Cedar Creek, and the South Fork of Cedar Creek are in a monitoring program conducted by the Saratoga-Encampment-Rawlins Conservation District (SERCD) associated with the project, however an assessment report has not been completed.

Streams in the Big Creek Drainage are fully supporting aquatic life uses on most of the forest, based on DEQ and Forest Service assessments. Problems with sediment loading from forest roads have been recently

addressed (MBRNF, 2003).

The Encampment River originates in the Mt. Zirkel Wilderness area in Colorado before it flows into Wyoming. Within a couple miles it flows into the Encampment River Wilderness Area. Assessment by DEQ indicates full aquatic life use support in the Encampment River and North Fork Encampment River. Flows are augmented in the Encampment River drainage due to a trans-basin diversion of water from the Little Snake drainage into Hog Park Reservoir for replenishing the North Platte water that Cheyenne diverts out of Douglas Creek. The increased flows in Hog Park Creek did cause some initial channel adjustment after the reservoir was completed in 1965, but the stream appears to be stabilizing. South Hog Park Creek was tie driven and carried a large sediment load and was unstable, so tree revetments were installed to help the stream establish a more natural shape and to improve the fishery. But the revetments were being removed by beaver for dam building because dams built with the small available willows could not withstand high spring runoff. Aspens are now being cut and hauled to the beaver so they will utilize the aspens instead of the revetments, so both can work to trap the sediment and restore the stream. Assessment by DEQ indicates South Hog Park Creek is fully supporting its aquatic life uses.

The North Fork of the Encampment River is the drinking water source for the Town of Encampment. Potential development of a Green Mountain resort and mountain community within the watershed resulted in the Town of Encampment obtaining Section 205(j) assistance funds to develop a Source Water Protection Plan. Additional monitoring and assessment work was a component of that project. The project expired in October 2005 and the project final report indicated full support of designated aquatic life uses and drinking water uses.

A diversion ditch in the Billie Creek drainage breached in the late 1990s, which eroded a gully and deposited approximately 3300 tons of sediment in Billie Creek and its flood plain. Restoration work on the gully was completed in 2001 to curtail erosion. Billie Creek was monitored in 2003, and initial data analysis indicates a healthy biotic community.

A 1984-86 AML remediation project removed a large (approximately 65,000 cubic yards) tailings pile generated by the mill and smelter in Encampment during the early 1900s, which reportedly resulted in considerable water quality improvement in the river. DEQ has conducted extensive monitoring in the drainage, and the majority of the stream miles are fully supporting their aquatic life uses.

Assessments conducted by DEQ in the upper Jack Creek drainage indicate it is supporting its aquatic life uses, as is upper South Spring Creek. The BLM recently changed grazing management on portions of Centennial Creek to improve riparian condition. SERCD has conducted monitoring on Jack Creek, below the National Forest, and the data indicate it is also fully supporting its aquatic life uses.

Sage Creek has a naturally high sediment load due to the highly erosive soils and arid climate in much of the watershed. It has been identified by several studies as the most significant contributor of sediment to the Upper North Platte River and is on the 303(d) List (WGFD, 1969; SCS, 1980; SERCD, 1998). Additionally, dam failures, road building, and past grazing practices have resulted in increased erosion and sediment loading, especially from the lower portion of the watershed. In 1997, SERCD, in cooperation with land owners, BLM, NRCS, and WGFD, began the Sage Creek Watershed 319 projects, which now encompass the entire watershed. The projects have expired but the BMPs are still in place and being maintained. The BMPs consist of a combination of short duration grazing, riparian and drift fencing, off channel water development, improved road management, grade control structures, and water diversion and vegetation filtering to reduce sediment loading from Sage Creek to the North Platte, and to improve water quality within Sage Creek. Data collected as part of the project already show reduced sediment loading to the North Platte River and improved riparian and range condition. SERCD has submitted "credible data" for a Use Attainability Analysis on Sage Creek suggesting that the current classification for the lower basin portion of Sage Creek should be a non-game fishery since it is an intermittent stream which flows thorough a marine shale basin that does not have the natural capability to

support a cold water fishery. Weight-of-evidence analysis indicates there are no impairments or threats to aquatic life or coldwater fisheries uses on Sage Creek, therefore it is being delisted from the 303(d) List.

Hugus and Iron Springs Draw drainages are Class 3B waters, with intermittent to ephemeral stream channels. According to the BLM, new and developing AMPs are expected to result in improved watershed condition. Sugar Creek flows through Rawlins and enters the North Platte just upstream of Seminoe Reservoir. Rawlins' waste water treatment plant discharges to Sugar Creek, but the stream rarely flows all the way to its confluence with the North Platte River.

### **Pathfinder-Seminoe Sub-basin (HUC 10180003)**

In the Pathfinder-Seminoe Sub-basin, North Platte River flow is regulated by Seminoe, Kortez, and Pathfinder Reservoirs. The sub-basin includes those areas, other than the Sweetwater and Medicine Bow Rivers, which drain into the North Platte River, or its reservoirs, between Pathfinder dam and the head of Seminoe Reservoir. Primary land uses in this sub-basin are grazing, irrigated hay production, coal mining and recreation. Underground coal mining began in the Hanna-Elmo area in the late 1860s to supply fuel for the transcontinental railroad, and resulted in extensive underground coal workings created over a period of years. AML completed three remediation projects in the Hanna area, which corrected the erosion and standing water impacts associated with coal slag piles and almost 200 coal mine related subsidence holes. Current coal mining activities are thought to have little impact on the water quality in this sub-basin or the Medicine Bow Sub-basin (HUC 10180004).

Pathfinder dam was completed in 1909, and provided the first regulation of flows on the river. Reservoirs also trap sediment and lower average water temperature, so the natural flow characteristics of the North Platte have not existed since then. An extremely productive tailwater fishery resulted after Seminoe Dam was completed in 1939, and was given the name Miracle Mile. Completion of Kortez Reservoir below Seminoe dam shortened the Miracle Mile area, but with the establishment of instream flow releases, it is still considered a premiere blue ribbon fishery and has been designated a Class 1 water.

WGFD has conducted fish tissue analysis of fish from Pathfinder and Seminoe reservoirs. Because methyl mercury concentrations in the larger walleye exceed the guideline of 0.5 mg methyl mercury/kg fish, Wyoming Department of Health has issued a fish consumption advisory. Women of childbearing age, pregnant women, nursing mothers and children under 15 are advised not to eat channel catfish, sauger, and walleye from Seminoe and Pathfinder reservoirs. Other people should eat no more than one to two meals per month of these fish. <http://www.health.wyo.gov/news.aspx?NewsID=134>. Because methyl mercury concentrations tend to be highest in older, generally larger fish, it is also recommended that smaller fish be consumed rather than larger fish. Wyoming does not currently have a numeric methyl mercury criterion for fish tissue. Fish tissue criteria for bioaccumulating substances are based on average daily consumption. Wyoming's water column numeric criteria for fish consumption are based on an average consumption of 6.5 grams fish/day. Extrapolating this quantity of fish consumption would give a fish tissue "criterion" of 1.0 mg methyl mercury/kg fish (1.0 ppb) (USEPA, 2001). This concentration has only been exceeded in one 28 inch walleye in Pathfinder Reservoir, and two 30 inch walleyes in Seminoe Reservoir when sampled by WGFD. Because the vast majority of game fish in these reservoirs have methyl mercury concentrations below 1.0 ppb, these reservoirs will not be listed on the 303(d) List.

Deweese Creek, which flows into Pathfinder Reservoir, is one of the few perennial streams in this sub-basin and is considered by DEQ as a reference stream for sand bottom streams in the Wyoming Basin Ecoregion.

### **Medicine Bow Sub-basin (HUC 10180004)**

The headwaters of the Medicine Bow Sub-basin are on the north slope of the Snowy Range. Water quality

characteristics change drastically as the streams flow from the metamorphic geology of the mountains through the easily erodible, fine grained sedimentary geology of the basin. This sub-basin drains into Seminole Reservoir. Land uses include logging in the mountains, grazing, irrigated hay production, recreation, coal mining, and oil and gas development. Coal bed methane development is also beginning in the watershed. Irrigation in the Medicine Bow River drainage (including Rock Creek) dates to at least 1870-1880, the time of railroad construction. The transcontinental railroad reached this area in 1868 and coal production began in 1869 near the now-abandoned town of Carbon to supply fuel for the railroad. AML has completed ten site investigations in this sub-basin, most related to coal and gravel production, and completed remediation of one early 1900s coal mine.

Water quality assessments conducted in the upper Medicine Bow River drainage above the town of Elk Mountain indicate full support of aquatic life uses. Extensive monitoring by DEQ, as well as several agencies and universities, also indicate full aquatic life use support in the Rock Creek drainage above McFadden.

### **Little Medicine Bow Sub-basin (HUC 10180005)**

The Little Medicine Bow Sub-basin drains the northwestern edge of the Laramie Mountains and the Shirley Basin. Land uses are primarily grazing and oil and gas development, together with historic uranium mining (1955 to the early 1980s). AML completed reclamation of about 1,650 acres of open pit uranium mines in Shirley Basin. Eroding radioactive mine waste piles which also contained elevated levels of selenium and heavy metals were removed. Leaching and runoff water from these waste piles had been impacting surface and ground water quality. Reclamation improved water quality and reduced off-site sediment transport. The Little Medicine Bow River originally flowed through the uranium ore location. During mining operations in 1972, the river was diverted to the east and shortened. The unstable new channel had down cut as much as fifty feet and drastically increased the sediment input to the drainage system. During reclamation the river channel was moved back to its former location, however the channel does not appear to have stabilized.

Shirley Basin Reservoir is classified as a 3B water, but is managed by the WGFD as a coldwater put and take fishery. Because it is a shallow reservoir, summer water temperatures can sometimes be above the numeric water criterion of 20°C considered protective of a coldwater fish. However, weight-of-evidence assessment by DEQ based on that higher use indicates full use support given the natural potential of the reservoir.

### **Sweetwater Sub-basin (HUC 10180006)**

The Sweetwater Sub-basin headwaters are in the South Pass area of the southern Wind River Mountains. The Sweetwater River is designated as a Class 1 water above Alkali Creek. Land uses in this sub-basin include grazing, irrigated hay production, historic gold and iron mining in the South Pass area, uranium mining in the Jeffrey City area, recreation, and oil and gas development.

At the western end of the sub-basin, AML has remediated and/or stabilized over 100 sites in the old Atlantic City - South Pass mining districts. The Carissa Mine site, a gold mine which operated from the late 1860s to the early 1970s, included a tailings pond and pile in a perennial tributary to Willow Creek near South Pass City. Approximately 7,000 cubic yards of tailings and contaminated subsoil were removed from the drainage, including clearing 1,200 feet of stream channel. The tailings appear to have caused elevated levels of arsenic, cyanide, and mercury in stream sediments and soils, however sampling by BLM and DEQ show relatively low levels of these contaminants in the water column in Willow Creek. Therefore the sediment mercury does not appear to be affecting water quality but could have a greater impact if the sediments were disturbed by dredging activity. Fish tissue sampling by WGFD show mercury levels below the FDA guideline action limit in filets but higher than the limit in gut tissues. This would not suggest a human health concern, but it could suggest a concern for piscivorous wildlife. DEQ assessment of Willow Creek shows full support of aquatic life uses.

Ambient monitoring of Crooks Creek, a tributary to the Sweetwater River near Jeffrey City, revealed a significant amount of oil in the sediments, in violation of water quality standards. The source of the oil is unknown at this time, but this stream is scheduled for TMDL development in 2008.

### **Middle North Platte Sub-basin (HUC10180007)**

The Kendrick Reclamation Project takes water out of Seminoe and Alcova Reservoirs for irrigation northwest of Casper. However, much of the irrigated soil contains naturally high levels of selenium, which is readily dissolved and transported by the irrigation water. Extensive studies by the U.S. Geological Survey (USGS), US Fish and Wildlife Service (USFWS), and the Bureau of Reclamation (BR) have determined the irrigation return flows contain high levels of selenium which result in selenium loading into the North Platte River and several streams, wetlands, and reservoirs within the project area. These loadings have resulted in numerous water quality criteria exceedences in the higher class waters (North Platte River, Casper Creek, and lower Poison Spider Creek) as well as documented impairments to wildlife in these and other waters within Kendrick (Oregon Trail Drain, Poison Spring Creek, Goose Lake, Rasmus Lee Lake, Thirtythree Mile Reservoir, and Ilco Pond). These waters have all been listed on the 303(d) List since 2000. An infrastructure repair project has been designed to improve the water quality in Goose Lake, Rasmus Lee Lake, Thirtythree Mile Reservoir, and Ilco Pond to protect migratory birds, and these waters have been given a low priority for TMDL development. The Natrona CCD uses 319 funding to monitor selenium and implement management practices to reduce selenium levels. These practices include increasing irrigation efficiency, and enhanced irrigation water efficiency through canal and lateral lining and piping. The Kendrick Watershed Steering committee submitted a watershed plan to DEQ in 2005 and that plan was approved in 2006.

Garden Creek flows off Casper Mountain through the City of Casper. Like many urban streams it has been channelized through the city and is now subject to more “flashy” runoff events due to the amount of impervious surface in the watershed. A Section 319 stream restoration project, sponsored by the City of Casper, NRCS and volunteers, has installed log and rock structures in Garden Creek through Nancy English Park to allow the stream access to its flood plain, provide habitat for non-game fish, and allow reestablishment of riparian vegetation.

### **Glendo Sub-basin (HUC 10180008)**

The Laramie Mountains border the Glendo Sub-basin on the southwest. This sub-basin includes all the drainages entering the North Platte River below LaPrele Creek (above Douglas) and above the Fort Laramie Canal (below Guernsey). North Platte water flow is regulated by Glendo and Guernsey Reservoirs. Primary land uses are grazing, irrigated agriculture, oil and gas development, and scattered gravel and limestone quarries.

Sunrise Mining District is located east of Hartville Canyon in a tributary drainage of the North Platte River. Copper mining began in the 1870s; long term iron mining in the district began in the 1890s. An AML reclamation and remediation project in the Sunrise Mining District remediated multiple water quality impacts from the mining.

Guernsey Reservoir is the site of the annual Guernsey silt run, an exception to the state turbidity criteria. After Guernsey Reservoir was completed in 1927, water released from the reservoir was described as practically sediment-free and is believed to have removed years of silt accumulation which had acted as a water seal in irrigation canals, and led to seepage and bank collapses which in turn impeded water flow. The practice known as the annual silt run began in 1936 as an attempt to deliberately remove accumulated sediment from Guernsey Reservoir and put enough silt and sediment into irrigation canals to seal them and prevent further erosion. The silt run took place approximately once each year from 1936-1957 by a planned flow reduction from Pathfinder

and subsequent drawdown of Guernsey. Glendo Reservoir, built between Pathfinder and Guernsey, was completed in 1958. Glendo functioned as a second sediment settling area for water entering Guernsey, with the result that water releases from Guernsey were referred to as “crystal clear.” The 1958 irrigation season was carried out without a silt run, but the practice was reinstated in 1959 and has been implemented each year since. The annual complete drawdown of Guernsey Reservoir, usually after July 4, takes about ten days and moves a significant amount of sediment out of the reservoir and into the downstream irrigation canals with return flow into the North Platte River. As a result of actions begun in 1983, the annual Guernsey silt run has been authorized in Wyoming turbidity standards.

Horseshoe Creek (Class 2AB) originates in the Laramie Range and flows east/northeast to its confluence with the North Platte River just below Glendo Reservoir. Monitoring was conducted by DEQ in the lower nine miles (from about 2.5 miles upstream of Spring Creek downstream to the North Platte River). Results of that monitoring indicate the lower 2 miles, and from Spring Creek upstream an undetermined distance above Section 26, T29N, R69W are fully supporting their aquatic life and fisheries uses. However, habitat degradation and lack of perennial flows from Spring Creek downstream approximately 4.5 miles prevent Horseshoe Creek from attaining similar aquatic life and fisheries use for most of this reach. The habitat degradation appears to be primarily related to changes in flow regime in this reach, but heavy grazing in some areas may compound the problem. Because legal flow depletion is considered pollution, this reach of Horseshoe Creek is in Category 4C, which does not require a TMDL.

#### **Lower North Platte Sub-basin (HUC 10180009)**

In Wyoming, this sub-basin includes the drainages, other than the Laramie River, which enter the North Platte River from the Fort Laramie Canal diversion downstream to above the confluence with Horse Creek (in Nebraska). Primary land uses are irrigated agriculture, dryland farming, and grazing.

#### **Upper Laramie Sub-basin (HUC10180010)**

This sub-basin includes all the drainages above Wheatland Reservoir #2. Major drainages in the Upper Laramie Sub-basin are the Laramie and Little Laramie Rivers whose headwaters are in the Medicine Bow Mountains. Land uses are logging, recreation, and grazing at higher elevations; grazing, irrigated hay production, and some oil and gas development in the lower elevations. The City of Laramie (third largest in Wyoming) lies in this sub-basin.

Extensive water quality assessments by universities, the Forest Service, and DEQ in the Little Laramie Drainage above Millbrook indicate that the majority of the streams and lakes are meeting their aquatic life uses.

DEQ assessment of the Middle Fork of Mill Creek indicates full support of its aquatic life uses.

Hanging Lake is a small shallow subalpine lake located in the Little Laramie River watershed. Other than snowmelt, most flow into the lake is from a diversion out of Nash Fork. It is managed as a put and take fishery, because it is too shallow (4.2 foot maximum depth) for fish to overwinter. Because Hanging Lake is so shallow, water temperatures can exceed the criterion for coldwater game fish, and the abundant vegetation can create high pH in the low ionic strength water, which has little buffering capacity. However, based on a weight-of-evidence assessment, Hanging Lake is meeting its designated aquatic life uses, given its natural potential.

Water quality monitoring by DEQ in 1997 on the Big Laramie River indicated full aquatic life use support above Jelm.

Miller Lake, in the Evans Creek watershed near Fox Park, is a small, shallow reservoir with a maximum depth of 9 feet. Because the low ionic strength of the water has little buffering capacity and the shallow lake is

inductive to abundant macrophyte growth, pH can be high during photosynthesis, but there is no indication of elevated nutrient levels. Miller Lake has a self-sustaining brook trout population, and is also stocked with rainbow trout. Winterkill can be a problem, however based on a weight-of-evidence assessment Miller Lake is meeting its designated aquatic life and coldwater fisheries uses, given its natural potential.

Water quality samples are collected by Laramie Rivers Conservation District (LRCD) during spring runoff on the Big and Little Laramie Rivers, for the past several years. The data show occasional high counts of fecal bacteria, but the geometric mean criterion has not been exceeded. Data from other times of the year were not collected. Because of the occasional high numbers further monitoring is recommended during both runoff and low flow conditions to determine if a fecal contamination problem exists.

Meeboer Lake is in the Laramie Plans Lake complex southwest of Laramie. Because it is a shallow lake, less than six feet at maximum depth, summer water temperatures can sometimes get above the numeric water criterion of 20°C considered protective of coldwater fish. However there are relatively cool locations in the lake where coldwater fish can move when water temperatures rise. Decay of heavy macrophyte growth during severe winters can cause low oxygen levels and fish kills used to be common before an aerator was installed. However, assessment by DEQ indicates full use support given the natural potential of the lake.

### **Lower Laramie Sub-basin (HUC10180011)**

This sub-basin runs from Wheatland Reservoir #2 downstream to the confluence with the North Platte River. Land uses include irrigated agriculture, grazing, dryland farming, and some logging in the Laramie Range.

Ammonia levels in Wheatland Creek often exceed water quality criteria in the winter and spring, indicating that aquatic life uses are not fully attained. Monitoring indicates the City of Wheatland's waste water treatment facility is a primary source of ammonia and a Waste Load Allocation has been approved by EPA. The city is working with DEQ/WQD on the installation of a non-discharging treatment system to address this issue. Additionally, Wheatland Creek often exceeds the pH criterion, likely also due to the discharge, and pH has been added as a pollutant on the 303(d) List.

Concerns expressed by several residents prompted DEQ to begin monitoring fecal bacteria in the Wheatland/Rock Creek drainage. Results of this monitoring indicate that Rock Creek and a portion of Wheatland Creek for an undetermined distance above and below Highway 320, are not meeting their uses for contact recreation. Therefore, these waters were placed on the 303(d) List. The Platte County Natural Resource District sponsored the watershed planning process to identify and address sources of fecal contamination, with a Rock Creek watershed plan completed and approved in 2007. Seventy-nine irrigation efficiency, 12 water quality improvement, 12 grazing management, and 32 wildlife habitat enhancement projects have been implemented, primarily using NRCS funding. Two animal feeding operation relocation projects have occurred in the Rock Creek drainage (WACD, 2007).

Assessments were conducted by DEQ in October of 1998 along the length of Chugwater Creek. Where access to the creek was provided by landowners, the stream appeared to meet its designated aquatic life uses as a Class 2AB water above Antelope Gap Road west of Wheatland, although nutrients were a concern. However, the 1998 assessment indicated the physical and biological character of the stream dramatically changed in a monitored reach several miles below the road. The stream bed changed to a mobile sand bed which supported very little aquatic life (less than half the number of taxa, and less than one percent of the number of individuals, compared with upstream reaches and other similar streams). WGFD fish data showed a similar reduction in fish numbers. Because of the mobile sand bed and the large reduction in aquatic life, this reach of Chugwater Creek was listed as threatened on the 303(d) List in 2000.

Platte County Resource District (PCRD) conducted monitoring on Chugwater Creek in 2000 and 2001 to verify the DEQ threatened listing and to better define the extent of the threatened reach. The listed reach was accordingly changed to: from the irrigation diversion in NE SW S26 T25N R67W upstream an undetermined distance below Antelope Gap Road. PCRD data also showed very high nitrate levels in Chugwater Creek, approximately 10 times higher than recommended concentrations for streams which ultimately flow into reservoirs. Affects of this nutrient loading on Gray Rocks Reservoir, downstream of Chugwater Creek on the Laramie River, are unknown and warrant further assessment.

Cooperative efforts among landowners, sponsored by WGFD and Pheasants Forever to improve riparian conditions and benefit wildlife were later implemented along this portion of Chugwater Creek. This consisted primarily of installing riparian fencing throughout grazed pastures. Additionally, the irrigation district built a small reservoir on a bench above the creek to improve irrigation efficiency by capturing excess irrigation water which previously flowed unrestricted down a draw into Chugwater Creek. Another management practice that was incorporated along Chugwater Creek after the 1998 assessment by DEQ included conversion from surface irrigation to more efficient sprinkler irrigation.

On January 28, 2005, the Water and Waste Advisory Board met to hear comments about the decision by DEQ to list Chugwater Creek on the 303(d) list for sedimentation and about the petition by PCRD to delist the creek based on additional data. At the meeting, it was determined that a technical review team (TRT), mediated by the Wyoming Department of Agriculture (WDA), would make an investigation of Chugwater Creek. This team would be comprised of a panel of experts to assist in making a final determination as to the appropriate condition of the stream. During a meeting led by the WDA and comprised of staff and stakeholders from the DEQ and PCRD, it was determined that the TRT would be comprised of four expert members in the fields of water quality, geomorphology, range science, and soil science. The purpose of the group was to determine whether the data collected by DEQ and PCRD was representative of the determinations by DEQ to list the creek, whether additional data were necessary to accurately assess creek conditions, to conduct an assessment of general watershed health, and prepare a report of the overall findings and recommendations for moving forward with a decision regarding stream impairment conditions.

The TRT and representatives from the DEQ and PCRD conducted an unrestricted site visit of the Chugwater Creek watershed on September 5, 2007. During the site visit, DEQ and PCRD were available to respond to questions by the TRT while they assessed the condition of Chugwater Creek. During the site visit, physical parameters including stream temperature, pH, electrical conductivity, dissolved oxygen and oxygen saturation were obtained. In addition, pre-selected locations in the upper, middle and lower watershed were assessed for impacts from sedimentation.

Following is a summary of the TRT conclusions on Chugwater Creek:

- Much of the previously collected data do not represent current conditions.
- Excessive sediment production and/or transport were not evident in the 7-mile stretch of Chugwater Creek that is listed as threatened.
- Extensive riparian areas have all been fenced to exclude grazing and stream banks appear stable.
- Improved grazing management (timing and location) has occurred.
- There is little stream bottom gravel substrate in Chugwater Creek for fish reproduction.
- Channel dimensions have adjusted down to accommodate reduced flows due to irrigation water management and several years of drought that have reduced in-channel sediment transport.
- Water gaps are a minimal source of off-channel sediment. The team recognized these sites are needed as a means to provide livestock management on the stream corridor as a whole.
- Sediment (point) bars are showing signs of vegetation establishment and stabilization with grasses and woody species.

Based on the findings by the TRT and review of information collected since October of 1998, DEQ concludes that the changing management practices within the Chugwater Creek watershed have eliminated the imminent threats to this stream and also resulted in repair to earlier stream conditions. Chugwater Creek is therefore being removed from the 303(d) list as threatened for sediment impairment.

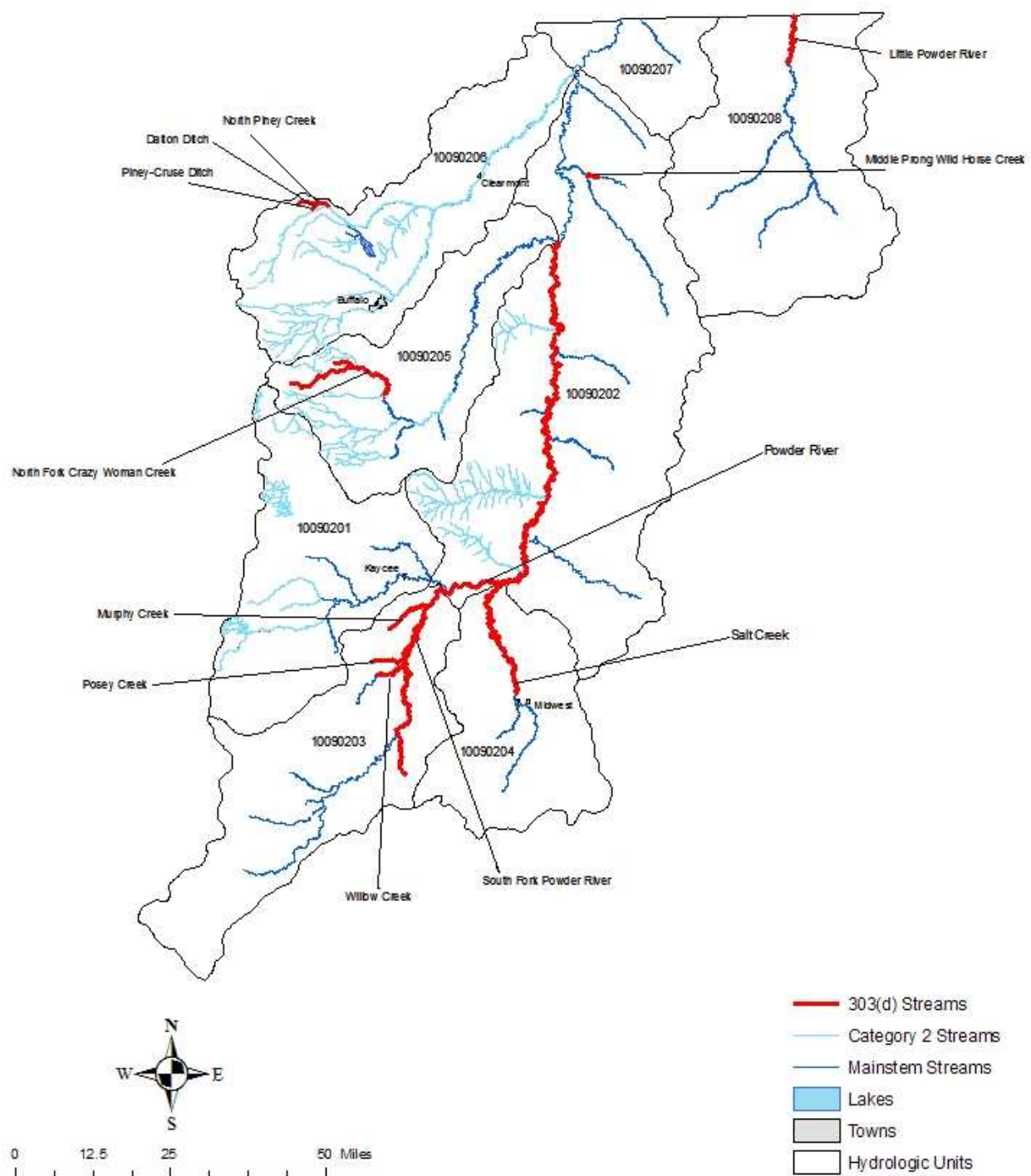
The Tunnel Reservoir on the Laramie River dams up water so it can be diverted through a tunnel into Bluegrass Creek to supply irrigation water in the Sybille Creek drainage. The reservoir is drained in the fall to prevent damage of the gates at the head of the tunnel. Because the reservoir was designed to release water from the bottom, the annual fall drawdown often discharged anoxic sediment from the bottom of the reservoir which resulted in fish kills downstream in the Laramie River. In 1997 reservoir modifications were made which allow the water to be released without disturbing the accumulated anoxic sediment.

#### **Horse Creek Sub-basin (HUC 10180012)**

Head waters of the Horse Creek Sub-basin are in the Laramie Mountains. Land uses are primarily grazing and irrigated hay production, with considerable dryland and irrigated cropping at lower elevations. Underground limestone mining occurred in the upper reaches of the watershed. AML has completed reclamation work at this site, including the rerouting of surface waters to prevent flows into the mine workings.

Watershed assessments on upper Horse Creek show that aquatic life uses are fully supported. Watershed assessments were conducted by DEQ on Bear Creek and the South and North forks of Bear Creek in 1999. The results of these studies indicate the streams are meeting their aquatic life uses. However, elevated temperature is a concern in the lower watershed since the stream is protected by water quality standards as a cold water fishery. WGFD manages lower Horse Creek as a non-game fishery. Dewatering and sedimentation are water quality concerns in the lower watershed.

## Powder River Basin 2008



## **Powder River Basin**

The Powder River flows north from central Wyoming into Montana. Nearly all of the naturally perennial streams which reach the Powder River originate in the Big Horn Mountains. The core of the Big Horn Mountains is composed of igneous and metamorphic rocks flanked by mostly well-indurated sedimentary rocks. The water quality of mountain streams is generally high quality, except in isolated areas where land use practices have led to excessive erosion and sediment loading. In the Powder River geologic basin away from the mountains, the geology consists of primarily fine grained sedimentary strata which are often high in dissolved constituents and most formations are easily eroded. Streams originating in the basin terrain, unless receiving discharge water, are generally ephemeral, flowing only in response to snowmelt and rainfall events. These streams are generally high in dissolved solids picked up from the soils and are often turbid due to the nature of the geology and thin soils. Because of these natural conditions, site specific criteria have been adopted and the numeric secondary human health criteria for manganese and iron no longer apply to most Class 2 waters originating in the Powder River geologic basin. The Powder River Basin contains aquatic communities and certain fishes, such as the sturgeon chub - a former candidate for listing under the Endangered Species Act, which are adapted to living in naturally turbid conditions (Patton, 1997). Although effects of coal bed methane (CBM) development on these aquatic biota are unknown at this time, DEQ, WGFD, and USFWS have concerns that these aquatic communities may be affected.

### **Middle Fork Powder Sub-basin (HUC 10090201)**

The upper Middle Fork of the Powder River flows through a steep canyon with little potential for disturbance. Watershed assessments conducted by DEQ indicate that the Middle Fork Powder River above Buffalo Creek, and Rock Creek, an upper tributary, are fully supporting their aquatic life uses. Near Barnum, Blue Creek, and upper Beaver Creek (above the Blue Creek confluence) have been assessed by DEQ and have been determined to be fully supporting their aquatic life uses.

Beartrap Creek is a spring fed tributary of Red Fork, and historically, the upper Beartrap Creek drainage has been used as a stock driveway and holding ground. Management practices have changed over the past twenty years. Today, livestock have controlled access to creek water, are moved through relatively quickly, and are only in the drainage for a short time in spring and fall. In a cooperative effort between BLM and WGFD, log spill structures were installed in 1989 to create additional pool and riffle habitat. Bioassessments conducted by DEQ show that both upper Beartrap Creek and Sawmill Creek are fully supporting their aquatic life uses.

Webb Creek is a class 2AB tributary to the North Fork of the Powder River. Assessment by DEQ indicates is fully supports aquatic life uses.

### **Upper Powder River Sub-basin (HUC 10090202)**

The Upper Powder Sub-basin encompasses most of the drainages into the Powder River main stem from the confluence of the North and Middle Forks downstream to the confluence of the Powder River and Clear Creek. Except for the main stem, most reaches in this semi-arid sub-basin are non-perennial. The Powder River got its name from the large amounts of very fine sediment it naturally carries. Sturgeon chub, a native fish considered rare by WGFD and now found only in the Powder River, are believed to be adapted to, and require, turbid water. Primary land uses are grazing, coal bed methane, and oil and gas production.

Pumpkin Creek is classified as Class 3B, and was monitored by DEQ in 1998. Assessment of that data showed that Pumpkin Creek was an ephemeral to intermittent stream that was supporting its aquatic life uses. However, since then, CBM development has started in the watershed. As part of the watershed based permitting process,

physical data was collected in the Pumpkin Creek drainage, in part to determine how much additional flow from CBM discharges the Pumpkin Creek drainage could handle without degradation. This monitoring showed that parts of the drainage now have perennial flows which reach to the Powder River, and also identified areas of severe erosion as well as a number of active headcuts. The earlier data collected by DEQ can no longer be considered representative of current conditions. Consequently, the determination that Pumpkin Creek was fully supporting its aquatic life uses can no longer be considered valid, and it has been removed from Category 2.

Likewise, Fortification Creek was monitored by DEQ in 1999, prior to CBM development, and showed full aquatic life use support at that time. However, due to recent CBM development in the watershed, that assessment may not be current.

Ninemile and Fourmile Creeks, near Sussex, are ephemeral class 3B tributaries to the Powder River. Dikes and small impoundments trap and help support riparian vegetation. Assessments by DEQ indicate full aquatic life use support in these watersheds.

Analysis of chloride data in the Powder River drainage show that the majority of chloride loading in the Powder River comes from Salt Creek, and the Powder River below Salt Creek was listed on the 1998 303(d) List for exceedences of the chloride criteria (230 mg/L at that time). Although the Powder River below Salt Creek has a new site specific criterion for chloride of 984 mg/L, which is not to be exceeded at any time, chloride concentrations occasionally exceed the new criterion at the USGS sampling site near Sussex, so the Powder River will remain listed on the 303(d) List for impairment due to chloride. As a result of the new site specific chloride criterion, the extent of the Powder River chloride impairment has been reduced to “an undetermined distance below Salt Creek.” Although Salt Creek does not appear to exceed its site specific chloride criterion of 1600 mg/L, any TMDL or Watershed-based Plan on the Powder River will need to address loading from Salt Creek (HUC 10090204) since it is the primary contributor of chloride loading to the Powder River.

Data collected at the USGS Sussex station also show exceedences of the state’s chronic selenium criterion and selenium was added as an impairment on the 303(d) List in 2000. More extensive data collection has occurred on the Powder River and its tributaries as part of the overall assessment of coal bed methane development on the river system. These data indicate that the selenium impairment extends downstream to the confluence with Clear Creek. The relatively low selenium concentrations found in Clear Creek apparently dilute the Powder River at this point to enable the river to meet the chronic selenium criterion. Historic USGS data and Powder River Conservation District (PRCD) data indicate the primary source of the selenium is the South Fork of the Powder River drainage, however Salt Creek occasionally has high concentrations of selenium which contributes to the loading in the Powder River. It is undetermined whether the selenium loading is natural or human induced.

### **South Fork Powder Sub-basin (HUC 10090203)**

The South Fork Powder Sub-basin lies mostly in Natrona County, extending into the Waltman area. The few perennial reach miles in this sub-basin are primarily in the Rattlesnake Hills headwaters area of Wallace Creek, the lower portions of Willow and Cottonwood Creeks and the lower portion of the South Fork main stem. Cave Gulch and Okie Draw flow perennially due to oil field discharges and into the South Fork. Grazing and oil and gas development are the primary land uses.

Data collected by USGS and Powder River Conservation District (PRCD) show chronic exceedences of the selenium criteria in the South Fork Powder River from the mouth up to an undetermined distance above Willow Creek. Data also show Willow Creek exceeding the selenium criteria. Both of these waters were placed on the 303(d) List in 2006. Further monitoring by PRCD shows that both Posey Creek and Murphy Creek, tributaries to the South Fork and immediately downstream of Willow Creek’s confluence, also exceed the chronic selenium criterion. Because of these data, both Posey Creek and Murphy Creek have been added to the 303(d)

List. The source of the selenium appears to be primarily due to the natural geology of the area, but anthropogenic loading can be a factor when these lands are irrigated, which dissolves extra selenium from these marine shales. Another possible loading source in some of these watersheds is discharges from oil treaters.

### **Salt Creek Sub-basin (HUC 10090204)**

The towns of Midwest and Edgerton lie almost in the center of the Salt Creek Sub-basin. Land uses are primarily grazing and oil and gas production. Several natural oil seeps have been documented along Salt Creek in the Midwest area, which led to development of the oil fields beginning in 1908. Most reaches in this semi-arid sub-basin are non-perennial. Salt Creek now has perennial flow due to discharge water from oil treaters, but reportedly is naturally non-perennial. Soils developed from fine grained sandstone and calcareous shales, are dry and easily eroded by wind or water.

Salt Creek is classified as Class 2C, a non-game fishery. Prior to the oil field discharges Salt Creek naturally carried a high load of salts when it flowed, hence its name. Studies conducted by PRCD confirm that the vast majority of perennial flow and chloride loading to Salt Creek and the Powder River are from discharge water associated with oil production. However, because of the high chloride concentrations in the creek, it exceeds the state criteria for protection of aquatic life, and was listed on the 303(d) List. A Use Attainability Analysis requesting a site specific chloride criterion of 1600 mg/L on Salt Creek has been approved. Because data do not show any exceedences of this criterion, chloride has been removed from the 303(d) List as a cause of impairment on Salt Creek. However, since Salt Creek is the primary contributor of chloride loading to the Powder River (HUC 10090202), any TMDL or Watershed-based Plan on the Powder River will need to address loading from Salt Creek.

Selenium data collected from Salt Creek shows exceedences of the aquatic life criterion for selenium, so selenium has been added as a cause of impairment to Salt Creek on the 303(d) List. At this time it is unknown whether the primary source of the selenium exceedences is natural or anthropogenic, but both of these sources are contributing. Data from the chloride UAA on Salt Creek indicate selenium concentrations in oil treater discharges approach the selenium criterion.

Salt Creek was also on the 303(d) List of threatened waters due to a high number of produced oil and water spills in the watershed, due primarily to the age of the oil production infrastructure. Most of this infrastructure dates to the 1960's, and spills are due primarily to a combination of the age of the infrastructure and bacterial corrosion in the injection lines. Although most of those spills usually do not make it to live water, some do. At the request of DEQ, the current operator of the field has developed a long term upgrade and maintenance plan for the field to reduce the potential for large spills that may affect the water. The operator is also phasing into CO<sub>2</sub> flood (injection of CO<sub>2</sub> to enhance oil recovery) which requires replacement of both injection and production lines. The operator is also upgrading water flood lines and since 2003 has been using biocide treatment field-wide to reduce bacterial corrosion. Because oil production is regulated by a variety of environmental laws to protect from such spills, and because a TMDL would do not reduce chances of spills, Salt Creek has been removed from Table C of the 303(d) list as threatened from oil spills and placed in Category 4B.

### **Crazy Woman Sub-basin (HUC 10090205)**

Headwaters of the Crazy Woman Sub-basin are on the east side of the Big Horn Mountains. Land uses are primarily oil and gas development, recreation, grazing, and irrigated agriculture.

The North Fork of Crazy Woman Creek is listed on the 303(d) List due to water quality threats from physical degradation of the stream channel. Several 319 watershed improvement projects have been conducted in this watershed which changed both irrigation and grazing practices in large portions of the watershed. Considerable

water quality data have been gathered in this watershed. However, it is inconclusive whether these practices have benefited water quality due to inconsistent sampling and implementation of best management practices within the watershed (BIO-WEST, 2001). DEQ conducted monitoring in the North Fork watershed, however, assessment to determine the effects the 319 projects had on improving water quality has not been completed. DEQ recognizes the restoration activities conducted in the North Fork watershed, and will review the data to determine if the threats have been mitigated and these waters warrant delisting.

EPA has established National Secondary Drinking Water Regulations that set non-mandatory water quality standards for 15 contaminants, including manganese. EPA does not enforce these "secondary maximum contaminant levels" or "SMCLs." They are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at the SMCL (USEPA, 1992). Wyoming's aesthetic drinking water criterion for manganese is set at the SMCL. Data collected near the mouth of Crazy Woman Creek exceeds the aesthetic drinking water criterion for manganese, primarily during low flows, although the aquatic life chronic criterion was not exceeded in any of the data. Lower Crazy Woman Creek was listed on the 303(d) List in 2002. However, high manganese concentrations are common in streams in the Powder River Structural Basin due to the natural geology (Wasatch and Fort Union Formations), and much of the basin does not even have a human health criterion for manganese in Chapter 1. There are no sources of anthropogenic manganese in Lower Crazy Woman Creek, and the creek is not used, nor is it likely to ever be used, for a drinking water source due to its intermittent flows. Lake DeSmet Conservation District has submitted a UAA requesting removal of the manganese drinking water criterion from Crazy Woman Creek. Because the weight-of-evidence indicates there are no existing or future drinking water uses on Crazy Woman Creek and there are no anthropogenic sources of manganese, it is being delisted from the 303(d) List. If the UAA is not approved, Crazy Woman Creek will be re-listed on the 303(d) List.

Many of the streams in this watershed have been monitored by DEQ, and assessment of the data indicates that the following streams are fully supporting their aquatic life uses:

- Crazy Woman Creek (from confluence of North and Middle Crazy Woman down to approximately 2 miles below Wallows Creek)
- Little North Fork Crazy Woman Creek
- Pole Creek (tributary to North Fork Crazy Woman Creek)
- Poison Creek (tributary to North Fork Crazy Woman Creek)
- Middle Fork Crazy Woman Creek
- Doyle Creek (above Taylor Creek)
- South Fork Crazy Woman Creek
- Beaver Creek
- Pole Creek (tributary to Beaver Creek)
- Billy Creek (tributary to Muddy Creek)

#### **Clear Creek Sub-basin (HUC 10090206)**

Headwaters of Clear Creek, Piney Creek, and Rock Creek are in granitic geologic materials in the Cloud Peak Wilderness Area within the Bighorn National Forest. Recreation, grazing, and logging are land uses within the higher elevations. Grazing, oil and gas development, irrigated agriculture and residential development are the primary land uses. Clear Creek is the last major tributary to join the Powder River upstream of the Wyoming-Montana state line.

A 205j water quality assessment project in the Rock Creek and North and South Fork Shell Creek drainages indicated that these watersheds were threatened by physical degradation of the stream channel. The primary degradation to Rock Creek has been identified as heavy grazing in small horse pastures. Data collected and

analyzed by DEQ indicate that aquatic life uses are supported in Rock Creek, however, there are areas where intensive land uses can threaten use support. Impacts to the North and South Fork Shell Creek drainages are primarily due to irrigation diversions and conveyance. Lake DeSmet Conservation District recently completed a 319 grant which addressed these problems primarily through installation of more efficient irrigation and irrigation delivery systems. Data collected as part of the project were inconclusive, with the wide variability in the biological data observed between sample years potentially being the result of inadequate sample sizes. A field visit to the watershed in 2005 suggested the implementations on the North and South Forks of Shell Creek were fairly effective. It was determined that a current set of credible data were needed to accurately assess use support and evaluate the effectiveness of the implementations. In response to that determination, DEQ assessment personnel conducted additional biomonitoring on the two forks of Shell Creek in 2006. Both forks of Shell Creek are Class 3B, however non-game fish were readily observed in both suggesting Class 2C classifications are more appropriate. A review of the assessment report for the 2006 monitoring indicates full support of designated Class 3B aquatic life uses as well as full support of existing non-game fisheries uses.

Based on reports of possible sewage in surface water and failed septic systems in Story, DEQ conducted a study of *E. coli* in the waters in the Story area. Results of that study showed exceedences of the criterion in Dalton Ditch and North Piney Creek. Therefore, North Piney Creek from its confluence with South Piney Creek upstream to an undetermined location below SW, NW Sec 12, T53N, R84W, and Dalton Ditch are on the 303(d) List. While *E. coli* counts in the Piney-Cruse Ditch were above DEQ's then proposed criterion of 126 colonies per 100 mL, they were below Wyoming's fecal coliform criterion at that time, so Piney-Cruse Ditch was not listed. However, because the data collected from Piney-Cruse Ditch exceed the new of *E. coli* criterion, Piney-Cruse Ditch has now been placed on the 303(d) List. Sheridan County is working under a 205j planning grant to study impacts from septic systems on shallow groundwater and the linkages between groundwater and surface water in the area. Based on the findings of this study, proper septic or sewer systems can be designed to bring these three waters into compliance with standards. These three waters have a "high" priority for TMDL development, which is expected to begin in 2009 and be completed by 2010. Several factors were considered in determining this priority. The high *E. coli* levels identified during the summer and fall of 2005 resulted in a determination by local health officials that there was a potentially significant human health concern from contact exposure to these waters, and the waters were posted with warnings. Another consideration was the long history of citizen complaints about septic system problems in the Story area, the shallow depth to groundwater and the fact that there are no other known potentially significant sources such as sewage treatment plants or confined animal feeding operations. Additionally, there are the statutory requirements of Section 35-11-304 of the Environmental Quality Act. This section of the Statute mandates certain standards, regulatory and enforcement requirements for programs which are delegated to local governments. The Administrator is required to periodically review such programs to determine their effectiveness. The DEQ believes that we would be abrogating our mandated responsibility if we did not give these waters a high priority. The high priority will assure that DEQ works with the local delegated authority to develop a timely and effective resolution.

A short reach of Hunter Creek was impacted from excessive sediment which washed off an adjacent road and was listed on the 1998 303(d) List. Road modifications and changes in maintenance have been implemented by the forest service to reduce this impact, and data indicate that Hunter Creek is now fully supporting all its aquatic life uses.

Based on DEQ assessment data, Little Piney Creek fully supports its Class 2AB aquatic life uses.

DEQ data also show that Boxelder Creek supports its aquatic life uses as a Class 3B stream. Because many non-game fish were noted during the assessment, Boxelder Creek may not be properly classified. However, even if Boxelder Creek was classified as a 2C non-game fishery, it appears that it would be fully supporting that use in the lower reach.

Clear Creek was monitored by DEQ in 1999, and the data indicate full support of aquatic life uses, however WGFD records indicate that flow alterations may occasionally have a negative effect on cold water fish. Several stream restoration projects on Clear Creek have given the stream access to its floodplain and improved riparian condition. The potential impacts of future CBM development in the Clear Creek drainage is currently an issue of concern among many of the irrigators along Clear Creek and the DEQ's CBM monitoring efforts and watershed permitting efforts are designed to help assess those potential impacts.

French Creek is a Class 2AB tributary to Clear Creek. Assessment by DEQ indicate impacts from flow augmentation, however it is meeting its aquatic life uses. LDCD has developed a watershed plan for French Creek as a proactive effort to improve water quality in this watershed even though the creek is not on the state's Section 303(d) list.

### **Middle Powder Sub-basin (HUC 10090207)**

The Middle Powder Sub-basin includes the lower portion of the Powder River in Wyoming before the Powder River flows into Montana. Historically, land uses have been primarily related to grazing with some oil and gas development. However, coal bed methane development is becoming a major land use in much of the sub-basin. Except for the Powder River main stem, reaches in this sub-basin are generally non-perennial. However, many of these stream beds have become perennial due to discharge of coal bed methane produced water. Examples include LX Bar, SA and Fence Creeks.

Monitoring was conducted on the Powder River by DEQ in 2000, but due to the very low to no flow conditions prior to sampling, a lack of comparable reference streams, and continually changing conditions due to CBM development, data was considered inconclusive. DEQ data will be combined with newer data (both from DEQ and other entities) to formulate an assessment of the Powder River. One such data source is water quality and biological (macroinvertebrates, fish, and algae) data collected as part of a long term, interstate, interagency monitoring effort began in 2005 (see Monitoring in Areas of Coalbed Methane Development, page 5). Although guaranteed, long-term funding to continue the program has not been secured, annual funding by BLM, DEQ, and USGS has supported the program through 2008. This more comprehensive dataset is primarily intended to support an adaptive management approach to CBM development, but secondarily may be used to supplement DEQ use support determinations on the river.

Selenium data collected from the Powder River near Arvada show exceedences of the aquatic life criterion, so the downstream extent of this impairment, originating primarily in the South Fork, extends to the confluence with Clear Creek.

Campbell County CD conducted monitoring in this sub-basin under a 319 agreement. Their monitoring indicated exceedences of fecal bacteria criterion in the lower reach of the Middle Prong of Wild Horse Creek. The Middle Prong of Wild Horse Creek is on the 303(d) List, from its confluence with Wild Horse Creek upstream an undetermined distance. Campbell County CD and the NRCS have assisted landowners in the watershed to implement 13 water quality improvement projects. It is currently not known if these actions will be sufficient to reduce pollutant loading to the point of the Middle Prong fully supporting the contact recreation designated use. Local stakeholders and the conservation district have initiated watershed planning in this watershed in 2007 (WACD, 2007).

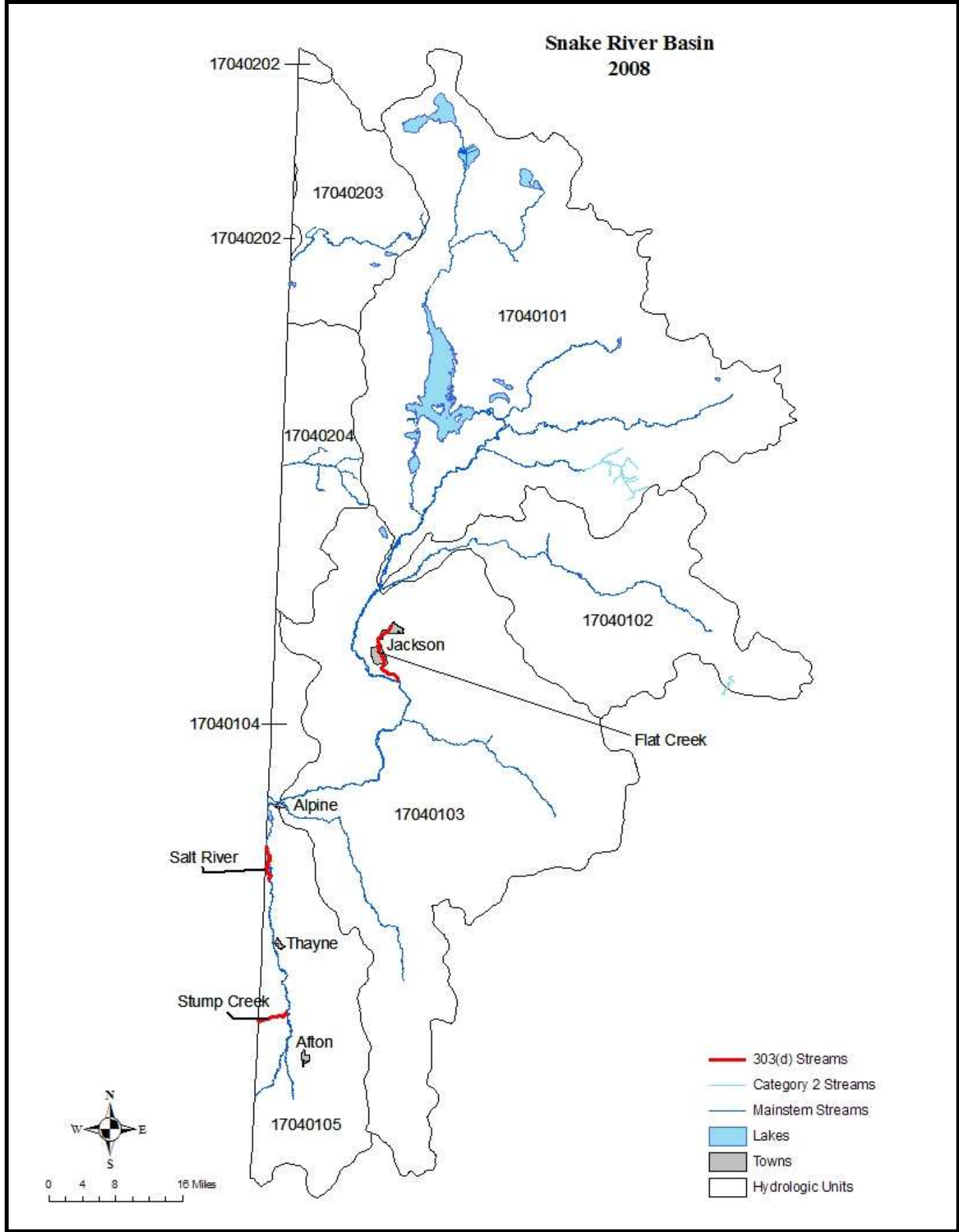
### **Little Powder Sub-basin (HUC 10090208)**

The Little Powder River originates near Gillette and flows north into Montana, east of the Powder River in Wyoming. Primary land uses in the Little Powder Sub-basin include coal mining, coal bed methane development, and grazing. Moyer Spring is fed by water accumulated in scoria beds and supports a small brook

trout population. Moyer Spring Creek and the Little Powder River are Class 2AB waters. All other creeks in this watershed are Class 3B waters.

USGS data collected from the Little Powder River, near the Montana line, have shown occasional exceedences of the fecal bacteria criteria, and subsequently the Little Powder River was placed on the 303(d) List. The Campbell County CD monitored in the Little Powder River Drainage, working under a 319 grant. Their data indicate that the lower reach of the Little Powder River does not support its contact recreation uses from the Montana line upstream an undetermined distance above Olmstead Creek. Campbell County CD and watershed citizens have sponsored a watershed plan for the Little Powder River. This plan was approved in 2007. To date, 8 animal feeding operation and 14 septic remediation projects have been implemented in support of that plan (WACD, 2007).

DEQ monitored the Little Powder River in 1999 and 2005, and the data are being evaluated to determine if aquatic life uses are supported. However, due to the dynamic nature of CBM development, it is difficult to make a use support decision due to the constantly changing conditions. By the time the data are analyzed, those data may no longer be representative.



## **Snake River Basin**

Headwaters of the Snake River are in the Sedimentary Subalpine Zone of the Middle Rockies Ecoregion. The Greys River and Salt River join at Palisades Reservoir which straddles the Idaho border. The Snake River crosses Idaho and joins with the Columbia River. In Wyoming the Snake River moves a lot of sediment and bedload material during high flow because of the relatively young, erosive geology in much of the basin. The basin in Wyoming consists mostly of steep mountains with several intermontane valleys. Jackson Lake and Palisades dams were constructed for irrigation water storage for agricultural activities in Idaho. Outdoor recreation is the primary land use and drives the economy in the basin.

### **Snake Headwaters Sub-basin (HUC 17040101)**

Waters of the Snake Headwaters Sub-basin originate in southern Yellowstone National Park, Grand Teton National Park, and the Teton Wilderness Area, and those are all Class 1 waters. This sub-basin extends from just above the Gros Ventre River confluence upstream. Buffalo Fork, Pacific Creek, and the Lewis River are the major tributaries in this sub-basin. Land use is primarily recreation, with areas of residential development, grazing and irrigated hay production.

The North Fork of Spread Creek was listed on the 303(d) List due to habitat degradation. A watershed improvement project, sponsored by the Bridger-Teton National Forest, has rehabilitated the stream channel and improved the stream's ability to support aquatic life. Assessment by DEQ indicates this stream is now meeting its aquatic life uses, and it has been delisted from the 303(d) List.

### **Gros Ventre Sub-basin (HUC 17040102)**

Waters of the Gros Ventre Sub-basin originate in the Bridger-Teton National Forest. Recreation, grazing, irrigated hay production, and logging are primary land uses.

DEQ assessment personnel monitored Crystal Creek immediately upstream of its confluence with Gros Ventre River as a random sample point in 2004. Stream restoration on a reach of Crystal Creek has narrowed and deepened the stream channel, and restored the stream's access to its flood plain.

Some areas of the sub-basin are thought to be impacted by heavy grazing and browsing by wildlife, causing bank erosion and channel widening, however detailed monitoring has not been conducted to verify use support. Recently a large grazing allotment was retired which may allow more forage for wildlife and reduce impacts to stream banks and riparian vegetation.

### **Greys-Hoback Sub-basin (HUC 17040103)**

Waters of the Greys-Hoback Sub-basin originate in the Bridger-Teton National Forest. Much of the southern part of this sub-basin is in the overthrust belt, which has naturally high rates of erosion due to a combination of poorly indurated, sedimentary geology, and geologically young mountains. Principal land uses are recreation, grazing, hay production, and considerable residential development. Oil and gas exploration has historically occurred in the watershed and a potential for expanded development exists.

Residential development and the rapidly growing population is a concern from a water quality standpoint. Water quality assessments conducted on Flat Creek by Teton Conservation District clearly indicate that the creek's ability to meet its aquatic life use support is threatened, primarily by urban runoff contributing excess sediment to the stream which limits aquatic habitat. Flat Creek is on the 303(d) List, and a watershed improvement project is underway to reduce sediment loading to the stream from urban sources. This project includes education and monitoring efforts, snow removal and stockpiling planning, and installation of

stormwater filtration systems to filter stormwater from the rodeo grounds as well as five urban sites. The Town of Jackson also has a commercial stormwater code, has initiated full time summer street sweeping, and has modified the type of salts it uses for ice control on town streets. A watershed plan has been completed by Teton Conservation District and was approved by DEQ in February of 2008. One major component of the watershed plan that should significantly improve water quality is the planned installation of a constructed wetland. This wetland will capture and filter run-off from several existing storm sewer systems. The engineering designs for this project have been completed and construction will begin in 2009. TMDL development on Flat Creek is planned to begin in 2009 with a completion date of 2010.

Geologic investigations along the Hoback River indicate heavy sediment loadings as a result of mass wasting, mudflows, slumping, snow and rock avalanches and landslides, but it is unknown how much this natural process has been accelerated by human activity (Ryan et al, 2003).

### **Palisades Sub-basin (HUC 17040104)**

Waters of Palisades Sub-basin originate on the west side of the Snake River Range in the Targhee National Forest. Land uses are primarily recreation and residential development. Much of this watershed is contained within the Palisades Wilderness Study Area and has a minimal amount of anthropogenic impact.

### **Salt River Sub-basin (HUC 17040105)**

The Salt River Sub-basin lies in an area of Wyoming known as Star Valley. Historically, land uses in the Valley have been predominantly associated with agriculture - irrigated small grain and hay production, dairy farming and beef production. However, today much of Star Valley is undergoing residential development. Recreation, grazing, and logging are primary land uses in the mountains surrounding the valley. Phosphate mining occurs in Idaho at the Smoky Canyon Mine immediately across the state line. Streams flowing through this mining area flow into Wyoming.

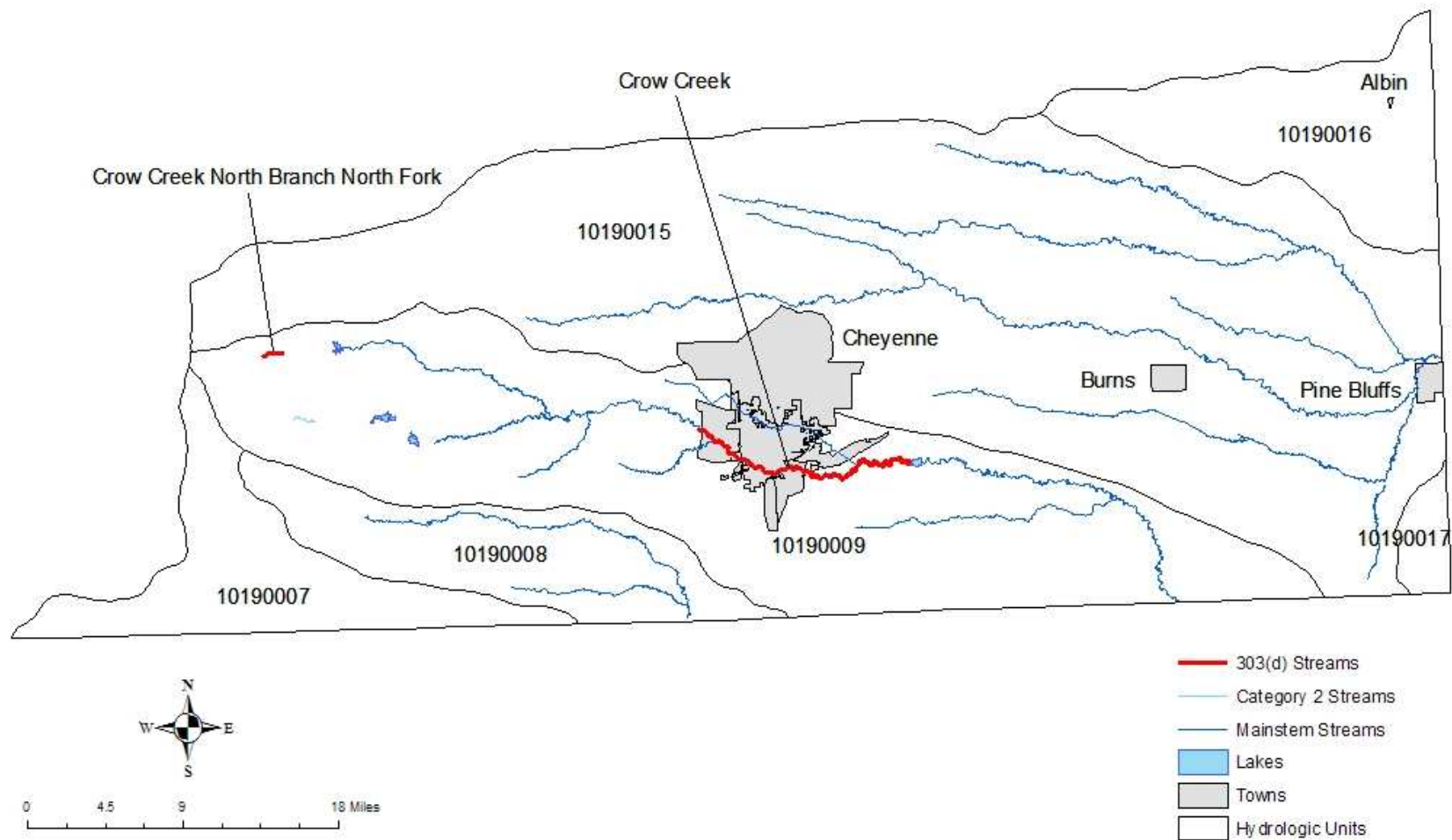
Studies have indicated that nutrient enrichment may be causing problems in some of the streams, but it has not been determined if the sources are due to agricultural activities, residential development, or both. The Star Valley Conservation District (SVCD) recently utilized a 319 project to provide public education and implement best management practices for agricultural nutrient management to reduce nutrient and fecal bacteria loading to streams in the watershed.

In 2002, a lower reach of the Salt River was placed on the 303(d) List as threatened for supporting its contact recreation use. Subsequent *E. coli* sampling by SVCD indicate that contact recreation uses are not fully supported, however, this change in status on the 303(d) List from “threatened” to “impaired” does not affect the timeline of any TMDL development or Watershed-based Planning efforts. Stump Creek flows into Wyoming from Idaho, and frequently exceeds the *E. coli* criterion near the state line. Therefore, Stump Creek has been added to the 303(d) List.

Phosphate mining at the Smoky Canyon Mine has impacted surface and groundwater resources in Idaho through selenium (Se) contamination. The Smoky Canyon Mine, along with other phosphate mines in the Idaho phosphate mining district, is under an Administrative Order of Consent in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) because of releases of selenium to the environment. CERCLA provides Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. A water quality grab sample taken in Crow Creek at the Idaho/Wyoming state line during spring runoff in May, 2006 had a total recoverable Se concentration of 5.2 µg/L. This concentration is greater than the state’s chronic criterion of 5.0 µg/L and the

state will conduct further water quality sampling during the 2008 spring runoff period. However, neither Crow Creek nor Salt River were added to the 2008 303(d) List as threatened or impaired due to selenium.

# South Platte River Basin 2008



## **South Platte River Basin**

The South Platte River Basin in Wyoming is only about 2000 square miles, or 2% of the state's total land area. Larger streams in the basin have their headwaters in the granitic Sherman Mountains of the Laramie range. These sub-basins generally drain toward the east and south into Nebraska and Colorado. Stream flows are generally perennial in the mountains and become intermittent on the plains. Native, non-game fish are adapted to these intermittent flows, and can even benefit from them because the flow regime limits colonization by many non-native fish species. Because of the sandy soils and low stream flows in much of the basin, most irrigation uses groundwater via sprinklers.

### **Cache La Poudre Sub-basin (HUC 10190007)**

A small portion of the Cache La Poudre Sub-basin is in Wyoming in the Laramie Mountains, before it drains south into Colorado. The primary stream in Wyoming's portion of this hydrologic unit is Dale Creek. Land use is primarily grazing, with limited hay production.

### **Lone Tree Sub-basin (HUC 10190008)**

Headwaters of the Lone Tree Sub-basin are in the Laramie Mountains, and the sub-basin drains to the east. The primary stream in Wyoming's portion of this hydrologic unit is Lone Tree Creek. Grazing is the primary land use, with limited irrigated and non-irrigated agriculture in the lower elevations.

### **Crow Creek Sub-basin (HUC 10190009)**

The Crow Creek Sub-basin originates in the Vedauwoo area between Laramie and Cheyenne. Its flows are supplemented by water from the Cheyenne Stage II Project which pipes water from the Douglas Creek drainage in the Upper North Platte Sub-basin to Crow Creek for a portion of Cheyenne's municipal water supply. Crystal, Granite, and North Crow reservoirs all lie in this sub-basin. Primary land uses are grazing, residential development, irrigated hay production, and both irrigated and dryland cropping in the lower sub-basin.

The city of Cheyenne appears to have a major impact on the water quality of Crow Creek (King, 1995; BRW/Noblitt and Wright-McLaughlin, 1978). Fecal bacteria contamination is a constant problem in Crow Creek, from Dry Creek upstream through Warren Air Force Base, and exceedences of the criteria for ammonia have also been recorded. Crow Creek is listed on the 303(d) List for these two pollutants. Although Wyoming does not have numeric criteria for nitrates and phosphates for protection of aquatic life, high levels of these nutrients are another concern. DEQ data show concentrations of these nutrients increase more than ten-fold, to levels well above any EPA proposed criteria, as Crow Creek flows through Cheyenne. Laramie CCD is conducting monitoring and working to provide education about water quality. With the City of Cheyenne, Laramie CCD has implemented management practices to reduce pollutant loading in Crow Creek. Implementations include construction of wetlands, riparian fencing and buffer strips to trap pollutants, irrigation system improvements, animal feeding operation projects, small acreage grazing projects, and storm drain stenciling. The district has also initiated a watershed planning effort and a watershed plan has been accepted and approved. Additionally, the greater Cheyenne metropolitan area is developing plans to address municipal stormwater. Both of Cheyenne's waste water treatment plants are using tertiary treatment which nearly eliminates ammonia loading to Crow Creek. However, it appears there may be other sources of ammonia in Crow Creek, so ammonia has not been removed as a pollutant from the 303(d) List.

The North Branch of North Fork Crow Creek and Middle Crow Creek were on the 303(d) List for exceedences of the fecal bacteria criterion, which indicated these streams were not meeting their contact recreation uses. Several years of data indicate that the high *E. coli* counts are primarily related to grazing practices, although recreational users and wildlife may play a role. The Crow Creek Watershed Steering Committee is addressing this issue and the Forest Service, in cooperation with stakeholders, has developed Water Quality Action Plans which combine BMP implementation, monitoring, and management of potential sources. The Forest Service has also released the Pole Mountain Improvements Project Scoping Statement to improve wildlife habitat, water quality, and livestock utilization in riparian areas on Pole Mountain. Weekly monitoring conducted by LCCD during the primary contact recreation season from 2005 through 2007 indicates Middle Crow Creek no longer exceeds the *E. coli* criterion, so Middle Crow Creek has been removed from the 303(d) List. LCCD monitoring indicates water quality improvements have occurred on the North Branch of North Fork Crow Creek, however the *E. coli* levels still periodically exceed the state's 30-day geometric mean criterion.

Sloans Lake in Cheyenne is frequented by a large number of ducks and geese, and also receives runoff from parks and streets. As a consequence, fecal bacteria levels occasionally exceed the level of concern for primary contact recreation for a short period nearly every year. During the summer, Laramie County Environmental Health Officials routinely monitor those levels and close the lake to swimming when fecal bacteria levels exceed the criteria for primary contact recreation. Although there are these occasional high counts, the state water criteria, which is based on a geometric mean, is not exceeded.

Although Dry Creek has intermittent flows near its confluence with Crow Creek, because of various water sources within Cheyenne, it is now a perennial stream within the city limits and supports a population of non-game fish, based on observations by DEQ biologists.

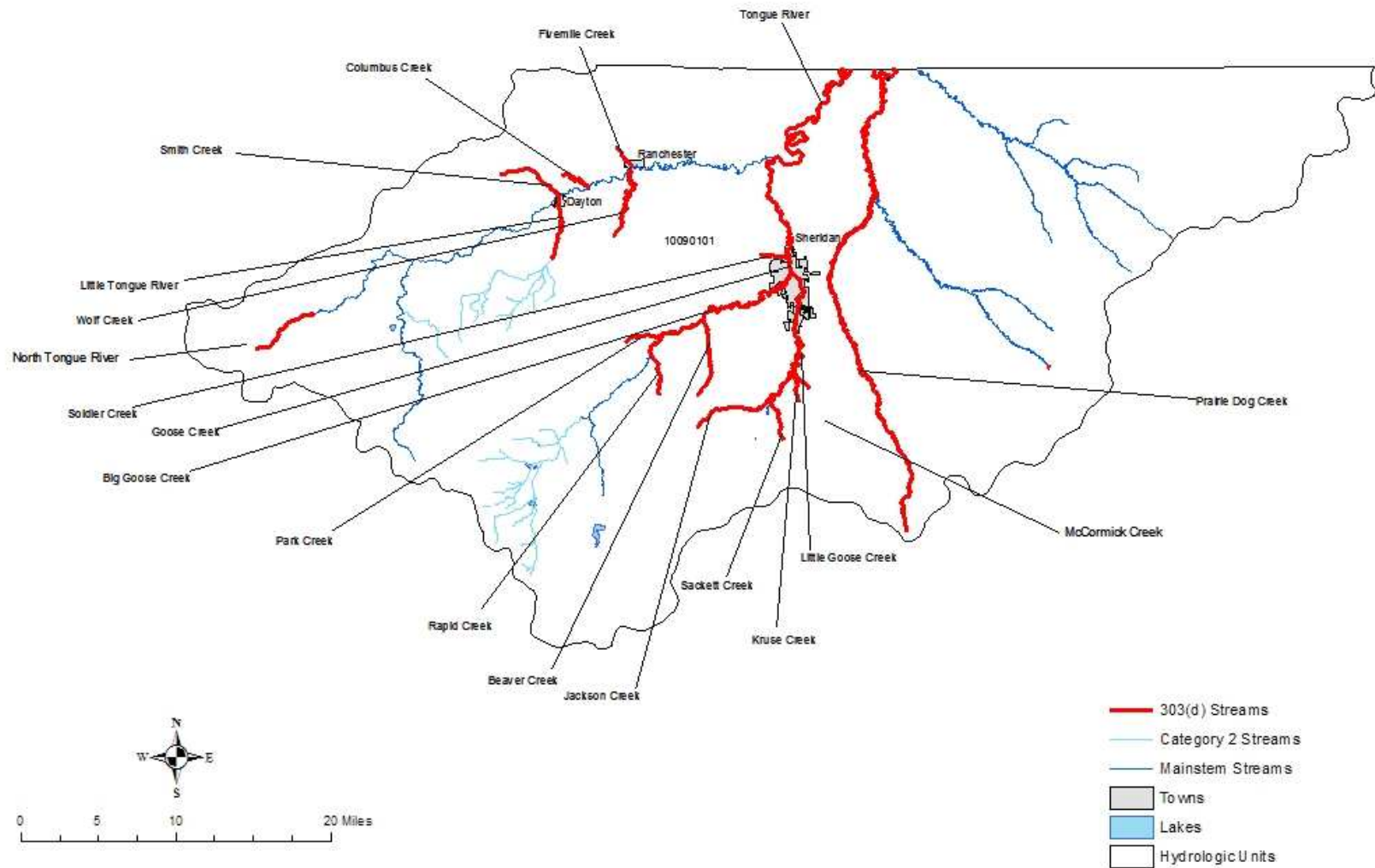
#### **Upper Lodgepole Sub-basin (HUC 10190015)**

The Upper Lodgepole Sub-basin originates in the Laramie Range, north of the Crow Creek Sub-basin and flows east through Pine Bluffs. Much of the stream is intermittent in the lower elevations with only isolated pools of standing water during the summer. The primary land use is agriculture with grazing in the upper sub-basin and irrigated and dryland crop production in the lower sub-basin. However, there has been considerable residential growth in the sub-basin in recent years, but effects of this growth on water quality are unknown.

#### **Lower Lodgepole Sub-basin (HUC 10190016)**

A small portion of the Lower Lodgepole Sub-basin is in eastern Laramie County, and it drains east into Nebraska. The sub-basin is small, with no perennial streams, and land uses are primarily dryland and sprinkler irrigated crop production, and grazing.

# Tongue River Basin 2008



## **Tongue River Basin**

The Tongue River Basin in Wyoming consists of a single sub-basin (HUC 10090101), originating in the Big Horn Mountains west of Sheridan. Land uses in the National Forest are recreation, grazing and logging. In the lower sub-basin, primary land uses are irrigated agriculture, grazing and coal mining; with increasing residential development and coal bed methane activity.

### **Tongue Sub-basin (HUC 10090101)**

Big Goose and Little Goose Creeks were placed on the 1998 303(d) List due to exceedences of the criteria for fecal bacteria. Subsequent monitoring by DEQ in 1998 and 1999 revealed exceedences in several other locations in these watersheds (Kruse Creek, Sacket Creek, and Jackson Creek irrigation canal - tributaries of Little Goose Creek; Beaver Creek, Park Creek, and Rapid Creek - tributaries of Big Goose Creek), as well as in Goose Creek and a tributary, Soldier Creek. Sheridan County Conservation District (SCCD) conducted fecal bacteria monitoring in the Goose Creek Watershed in 2001 and 2002, which generally confirm the findings from the 1998-1999 DEQ study (SCCD, 2003). Their findings also extended the reach of Goose Creek that is not meeting its contact recreation uses from the confluence of Big and Little Goose Creeks downstream to the Highway 339 bridge crossing, and indicate that McCormick Creek is not meeting its contact recreation uses from the confluence of Little Goose Creek upstream an undetermined distance. All these streams are on the 303(d) List. SCCD, under the guidance of a local watershed steering committee, developed a watershed plan for the Goose Creek watershed, which was approved by DEQ in 2005. Implementation projects have begun, including septic system improvements, animal feeding operations, riparian buffer development, streambank stabilization, reservoir development and changes in grazing management.

SCCD data collected in 2001 and 2002 showed exceedences of the temperature criteria for cold water fisheries in lower parts of the Goose Creek drainage, and less than optimal biotic condition close to Sheridan. Because the data were collected during near record low flows, which can mimic pollution effects on water temperature and biotic condition, definitive aquatic life and fisheries use decisions could not be made based solely on these data. DEQ has since sampled stormwater, conducted further biological assessment of the streams in Sheridan, and completed a study of stormwater runoff. Assessment of SCCD and DEQ data indicate that stormwater discharges are contributing excessive fine sediment that is causing physical degradation of Little Goose and Goose Creeks within Sheridan, and is keeping these reaches from supporting their aquatic life and fisheries uses. Both of these reaches are also on the 303(d) List due to sediment.

TMDL development for all the listed waters and pollutants in the Goose Creek watershed is scheduled to begin in 2009 with an expected completion date of 2010.

Beaver Creek is classified as 3B, however SCCD reports it to have perennial flow, even during drought conditions, and suggests that it be reclassified to class 2AB (SCCD, 2000; SCCD, 2002).

DEQ has conducted assessments and completed an assessment report on the Tongue River which concludes that the lower Tongue River is impaired as a cold water fishery due to high temperatures. Additionally, the USGS began continuous monitoring of temperature which shows that the temperature criterion was exceeded every day for a 30 day period in 2001, and it was only met during portions of 4 of those 30 days. Elevated temperature readings were again observed at this USGS station during the 2002, 2003, and 2004 water years where 4 of 12 monthly samples, 2 of 12 monthly samples, and 3 of 20 bi-monthly samples, respectively, had water temperature readings at or greater than 20° C. It has not been determined to what extent these high temperatures are anthropogenically influenced, but the reports cite loss of riparian cover and irrigation diversion

as possible contributing factors. Because of the chronic high temperatures, the Tongue River, below Goose Creek, is on the 303(d) list. DEQ has conducted continuous temperature monitoring in the Tongue River at several sites. Analysis of these data is currently in progress.

Assessments conducted by SCCD (SCCD, 2000) indicate that the lower reach of the Little Tongue River from its mouth up to an undetermined distance above the town of Dayton is not meeting its contact recreation use due to exceedences of the criteria for fecal bacteria. This reach has been listed on the 303(d) List. Additionally, SCCD analysis of “credible data” identified concerns about effects of habitat degradation on the biological community in and near Dayton. Assessment of data collected on the Little Tongue River since 1996 indicates it is not supporting its aquatic life and coldwater fisheries uses due to flow depletion, from the Tongue River upstream to the Frisbee Ditch. This reach has been placed in Category 4C because the impairment is due to pollution, but not a pollutant. Above the Frisbee Ditch, the Little Tongue River is fully supporting its aquatic life and coldwater fisheries uses.

Other fecal bacteria data collected in Dayton by SCCD indicate that Smith Creek also does not meet its contact recreation use, therefore it is listed on the 303(d) List.

SCCD also conducted assessments on Columbus Creek which indicate that its contact recreation use is impaired (SCCD, 2000), and the stream has been listed on the 303(d) List due to high fecal bacteria counts near the Highway 14 crossing. Occasional high fecal bacteria counts on Wolf Creek indicated that its contact recreation use is threatened and it was listed on the 303(d) List in 2002.

In Ranchester, a monitoring site on Five Mile Creek has recorded fecal bacteria counts whose geometric mean exceeds criteria, indicating it does not meet its recreational contact use (SCCD, 2000). Five Mile Creek is listed on the 303(d) List).

SCCD developed and finalized a watershed plan for the Tongue River watershed from the town of Ranchester upstream to the Bighorn National Forest boundary. The district has received a 319 grant to address these issues. Implementation measures include animal feeding operation projects, riparian buffer development, streambank stabilization, reservoir development, and grazing management changes.

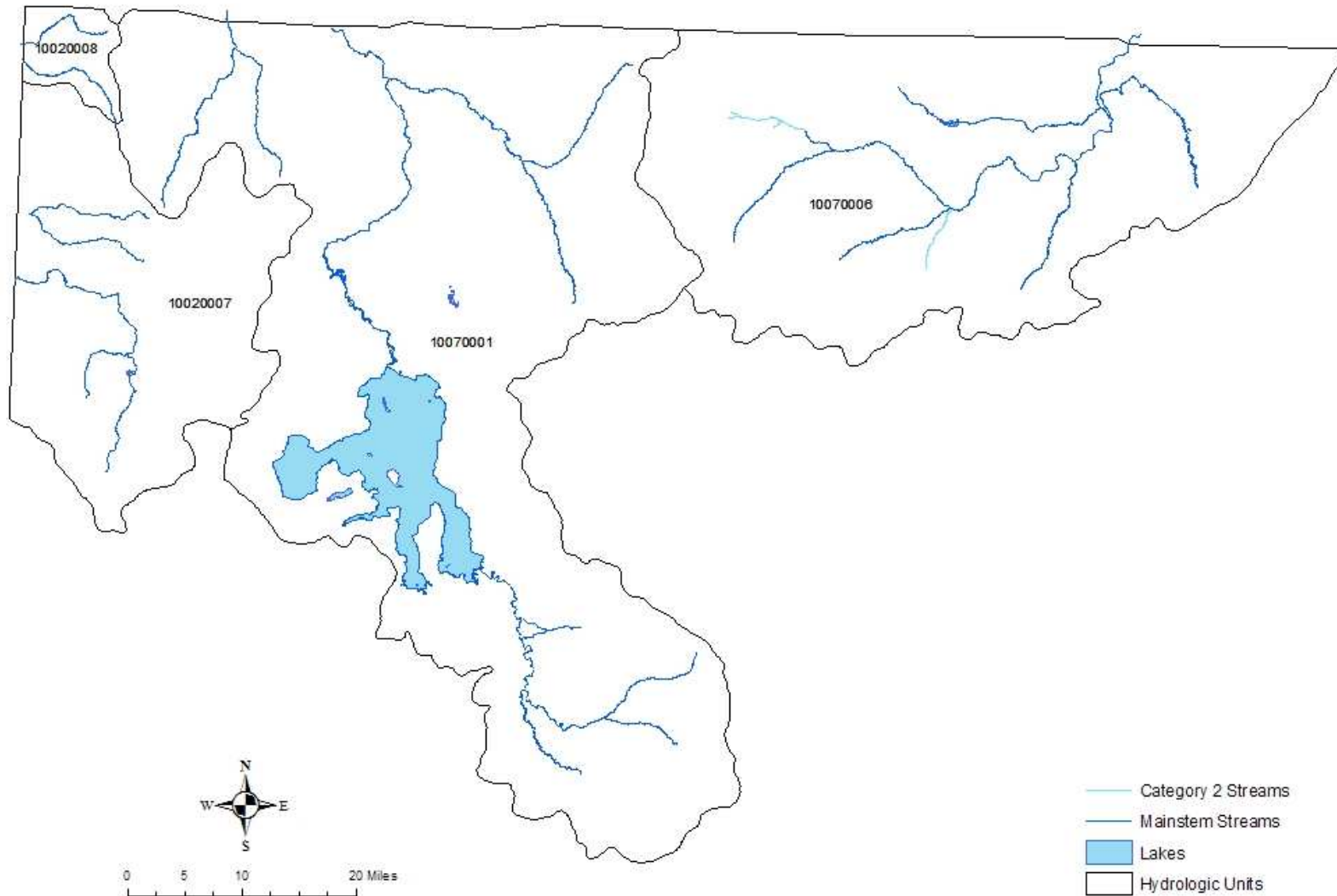
Prairie Dog Creek, a tributary to the Tongue River, receives water from a trans-basin diversion, and that added flow is thought to have contributed to habitat degradation in portions of the stream channel (EnTech, Inc., 2001). A joint riparian improvement project between the WGFD and a landowner has rehabilitated part of the stream channel with a marked improvement in the habitat in the stream and riparian area. DEQ and SCCD have conducted considerable monitoring in the Prairie Dog Creek watershed. Data collected indicates that the majority of the stream reaches support their aquatic life uses, although isolated areas of poor habitat do exist, and there are some concerns about high water temperatures in the lower watershed. High *E. coli* counts in Prairie Dog Creek exceed the criterion, indicating that it does not support its contact recreation use, so Prairie Dog Creek is listed on the 303(d) List. SCCD is sponsoring a watershed planning effort on Prairie Dog Creek. Prairie Dog Creek is also on the 303(d) List due to exceedences of the water quality criteria for manganese which indicates it is partially impaired for its aesthetic drinking water use. The manganese concentrations in Prairie Dog Creek are much below the human health criteria, but can cause discoloration of the water and staining of cooking utensils. It is likely that the high manganese concentrations are due to the natural geology of the area, which is similar to much of the Powder River geologic basin (Rice et al, 2002). A site specific criterion is being considered for the next triennial review.

High fecal bacteria counts in a reach of the North Tongue River in the Big Horn Mountains indicate this stream is not supporting its contact recreation use. A diverse stakeholder group, sponsored by the Bighorn National Forest is working together in this watershed to manage this resource. The Forest Service is currently monitoring the watershed and that agency and the stakeholder group are using those data to recommend,

implement, and assess stocking rate and herding changes on the allotments within the watershed. The formal stakeholder involvement coupled with federal land management and allotment planning is considered equivalent to watershed planning and the North Tongue River has been given a low priority for TMDL development.

Assessments conducted by DEQ on Prune Creek, Coney Creek, and the West Fork of Big Goose Creek indicates that these streams are supporting their aquatic life uses. BHNF and DEQ teamed up to remove improperly designed fish habitat structures within a grazing enclosure on Bull Creek that were causing channel widening and excessive sediment deposition.

### Yellowstone River Basin 2008



## **Yellowstone River Basin**

The headwaters of the Yellowstone River originate in the Teton Wilderness Area south of Yellowstone National Park (YNP). The river flows north into YNP and then into a large caldera, where it forms Yellowstone Lake. After leaving the lake, the river flows north through the park and enters Montana and confluences with the Missouri River.

### **Yellowstone Headwaters Sub-basin (HUC 10070001)**

In Wyoming, this sub-basin lies entirely within the Teton Wilderness Area or Yellowstone National Park; subsequently all its waters are designated Class 1. More than half of YNP lies in this sub-basin. Recreation and wildlife habitat are the primary land uses in the sub-basin. More than 3 million of people visit YNP each year, however, most of the sub-basin is wilderness and sees very few people.

Concerns about contamination by pathogens have been expressed after several recent sewage spills in YNP. However, major overhaul of some sewage infrastructures has begun, which should greatly reduce the risk of future spills.

Large portions of this sub-basin were involved in the 1988 Yellowstone fires and subsequent fires of less magnitude in subsequent years. However, any water quality impacts from the fires are considered natural, so would not be considered an impairment for the purposes of this report or the 303(d) List. Likewise, water quality criteria exceedences associated with the many geothermal features in this sub-basin are not considered an impairment.

Many areas within YNP have been heavily grazed by elk and/or bison and many concerns of water quality impacts have been reported (Houston, 1982; Singer, 1996; YNP 1997). For example, historical photos of the lower Lamar River Valley show thick stands of willows which are very important for stabilizing this type of stream. However, most of the willows have been eradicated by long duration grazing and browsing by wildlife, and, as a consequence, considerable bank erosion has occurred along the river. With the reintroduction of wolves to YNP, wildlife are moving around more and spending less time in riparian areas, which are making a dramatic recovery (Ripple and Beschta, 2003).

Soda Butte Creek, a tributary to the Lamar River, originates in Montana in an area of historical mining disturbance, including the McLaren mill tailings and defunct Republic Smelter. As a result of these impacts, Soda Butte Creek is on the Montana 303(d) list. Impacts to surface waters within Yellowstone National Park in Wyoming have not been conclusively determined (Broughton, 2001). The State of Montana has an approved TMDL (2003) for Soda Butte Creek and therefore any possible impaired declaration within Wyoming would result in the creek being placed in Category 4A and not placed on the Section 303(d) list. Information on Montana's Cooke City TMDLs can be found at:  
[http://www.deq.state.mt.us/wqinfo/TMDL/Cooke\\_City\\_files/FinalCCTMDL.pdf](http://www.deq.state.mt.us/wqinfo/TMDL/Cooke_City_files/FinalCCTMDL.pdf).

In response to the environmental conditions associated with the New World Mining District, the Gallatin National Forest and State of Montana have initiated and completed considerable mine tailings relocation and reclamation work in the watershed and project annual reports indicate water quality is improving in Soda Butte Creek at the Yellowstone National Park boundary (Tetra Tech, 2007).

### **Clarks Fork Yellowstone Sub-basin (HUC 10070006)**

The Clarks Fork headwaters are in Montana, and it flows southeast into Wyoming. Near the confluence with Sunlight Creek, it swings to the northeast, then flows back into Montana where it confluences with the Yellowstone River. The section of the Clarks Fork in Shoshone National Forest is Wyoming's only designated Wild and Scenic River and is designated a Class 1 water. The upper two-thirds of the sub-basin in Wyoming is primarily Shoshone National Forest land, with small private in-holdings. Land uses in the upper sub-basin are primarily recreation, with some logging, grazing, irrigated hay production, and historic mining. Portions of the upper sub-basin were involved in the 1988 Yellowstone fires and subsequently salvage logged. Land uses in the lower sub-basin are primarily grazing, irrigated agriculture, and areas of oil and gas production.

The Clarks Fork of the Yellowstone was on the 303(d) List due to exceedences of the criteria for copper, silver, and cadmium, indicating partial impairment of its aquatic life uses. The source of these metals has been determined to be primarily from past mining activities in the New World Mine area in Montana. Remediation is currently taking place and TMDLs have been written, which are expected to fully address the metal impairments in Wyoming. Therefore, the impaired reach of the Clarks Fork in Wyoming is in Category 4A. Information on Montana's Clarks Fork TMDLs can be found at [http://www.epa.gov/waters/tmdl/docs/10746\\_FinalCCTMDL.pdf](http://www.epa.gov/waters/tmdl/docs/10746_FinalCCTMDL.pdf).

A 319 watershed improvement project on Squaw Creek moved a stretch of the road out of the riparian area to reduce sediment loading and degradation of the stream. The final report from this project shows that the water quality threat has been removed and that the stream is supporting its aquatic life and cold water fishery uses (Page and Zubik, 2001).

A Shoshone National Forest stream bank stabilization project completed in 1997 on Pilot Creek successfully stabilized about 150 feet of stream bank and has reduced sediment transport from this drainage into the Clarks Fork.

DEQ assessment of lower Dead Indian Creek indicates full support of aquatic life and coldwater fisheries uses from the confluence with the Clarks Fork upstream to Dry Creek.

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## Designated Use Support Summary Tables

**Table 2A. Individual Use Support Summary for Assessed Wyoming Streams and Rivers**

Use	Total Miles	Miles Assessed	Miles Fully Supporting	Miles Fully Supporting and Threatened	Miles Not Supporting	Miles Not Assessed	Miles with Insufficient Info
<b>Aquatic Life other than Fish</b>	7370.1	6764.5	6064.2	146.9	553.4	556.0	49.6
<b>Cold Water Fishery</b>	6236.8	5750.3	5381.1	132.4	236.7	467.8	18.7
<b>Warm Water Fishery</b>	350.1	344.6	166.1	0.0	178.5	0.0	5.4
<b>Non-Game Fish</b>	137.6	115.7	0.0	0.0	115.7	21.9	0.0
<b>Recreation</b>	7370.1	795.9	1.6	115.1	679.2	6551.8	22.4
<b>Wildlife</b>	379.6	379.6	40.3	0.0	339.4	0.0	0.0
<b>Drinking Water</b>	15.6	6.3	0.0	0.0	6.3	0.0	9.3

**Table 2A. Individual Use Support Summary for Assessed Wyoming Lakes**

Use	Total Acres	Acres Assessed	Acres Fully Supporting	Acres Fully Supporting and Threatened	Acres Not Supporting	Acres Not Assessed	Acres with Insufficient Info
<b>Aquatic Life other than Fish</b>	6655.6	6655.6	418.0	0.0	6237.6	0.0	0.0
<b>Cold Water Fishery</b>	433.4	433.4	418.0	0.0	15.4	0.0	0.0
<b>Warm Water Fishery</b>	6075.8	6075.8	0.0	0.0	6075.8	0.0	0.0
<b>Recreation</b>	6655.6	0.0	0.0	0.0	0.0	6655.6	0.0
<b>Wildlife</b>	146.4	146.4	0.0	0.0	146.4	0.0	0.0

**Table 3. Summary of Causes Impairing Wyoming's Assessed Waters**

<b>Cause</b>	<b>Miles</b>	<b>Acres</b>
<b>Pathogens</b>	790.7	0.0
<b>Low flow alterations</b>	32.2	0.0
<b>Habitat alterations</b>	178.4	0.0
<b>Sedimentation</b>	63.9	6091.2
<b>pH</b>	12.2	0.0
<b>Temperature, water</b>	22.4	0.0
<b>Ammonia</b>	45.4	0.0
<b>Phosphate</b>	0.0	15.4
<b>Chloride</b>	64.8	0.0
<b>Cadmium</b>	12.4	0.0
<b>Copper</b>	17.0	0.0
<b>Silver</b>	12.4	0.0
<b>Manganese</b>	6.3	0.0
<b>Selenium</b>	348.8	145.4
<b>Oil and Grease</b>	22.7	0.0

**Table 4. Summary of Sources Impairing Wyoming's Assessed Waters**

<b>Source</b>	<b>Miles</b>	<b>Acres</b>
<b>Irrigated Crop Production</b>	162.4	6221.2
<b>Grazing Related Sources</b>	143.5	0.0
<b>Habitat alterations</b>	51.4	0.0
<b>Industrial Permitted Discharges</b>	44.7	0.0
<b>Abandoned Mine Lands</b>	6.5	0.0
<b>Municipal Point Source Discharges</b>	29.6	0.0
<b>Discharges from Municipal Separate Storm Sewer Systems</b>	44.7	15.4
<b>Natural</b>	158.5	0.0
<b>Resource Extraction</b>	17.0	0.0
<b>Unknown</b>	861.7	0.0

**Table 5. Category 2 Waters which Support One or More Designated Uses**

Basin	ID 305B	Name	Location	Class	Miles/ Acres	Supported Use(s)
Belle Fourche	WYBF101202010903_01	Blacktail Creek	Blacktail Creek above National Forest boundary	2AB	22.1	Cold Water Fish, Aquatic Life
Belle Fourche	WYBF101202010906_00	Beaver Creek	Above Lame Deer Creek	2AB	58.5	Cold Water Fish, Aquatic Life
Belle Fourche	WYBF101202010906_02	Wood Canyon Creek	Wood Canyon	3B	2.3	Aquatic Life
Belle Fourche	WYBF101202010906_03	Reservoir Gulch	Tributary to Beaver Creek	3B	2.5	Aquatic Life
Belle Fourche	WYBF101202010906_04	Cub Creek	Tributary to Beaver Creek	2AB	2.2	Cold Water Fish, Aquatic Life
Belle Fourche	WYBF101202010906_05	Little Creek	Tributary to Beaver Creek	3B	1.5	Aquatic Life
Belle Fourche	WYBF101202010906_06	Fawn Creek	Tributary to Beaver Creek	3B	2.9	Aquatic Life
Bighorn River	WYBH100800010110_01	Trappers Creek	Tributary to Warm Springs Creek	2AB	7.4	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800010408_00	Bear Creek	Entire Bear Creek watershed; tributary to East Fork Wind River	2AB	79.9	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800010409_00	Wind River, East Fork	East Fork Wind River above Wiggins Fork	2AB	196.1	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800020301_01	Little Beaver Creek	Tributary to upper Beaver Creek	2AB	13.6	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800030103_01	Deep Creek	Tributary to Red Canyon Creek	2AB	7.2	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800030207_02	Baldwin Creek	Baldwin Creek	2AB	44.2	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800030210_00	Squaw Creek	Squaw Creek Watershed	2AB	22.5	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800070607_01	Grass Creek	Grass Creek above irrigation withdrawal in NENE S23 T46N R99W	2AB	65.3	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800070609_01	Cottonwood Creek	From Bighorn River up to Hamilton Dome Oil Field.	2AB	33.0	Cold Water Fish, Aquatic Life, Wildlife
Bighorn River	WYBH100800080603_01	Soldier Creek	Tributary to South Fork Paint Rock Creek	2AB	7.7	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800100101_01	Mail Creek	Tributary to Shell Creek	2AB	2.4	Cold Water Fish, Aquatic Life

Basin	ID 305B	Name	Location	Class	Miles/ Acres	Supported Use(s)
Bighorn River	WYBH100800100502_01	Crooked Creek	Crooked Creek from irrigation diversion in SWNW S29 T58N R95W upstream to Montana line	2AB	3.8	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800100600_01	Porcupine Creek	Porcupine Creek watershed	2AB	76.8	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800120000_00	North Fork Shoshone River Drainage	North Fork Shoshone River above National Forest boundary including those tributaries	2AB	746.7	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800160100_01	Little Bighorn River	Little Bighorn River watershed	2AB	54.7	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800160107_01	West Pass Creek	West Pass Creek	2AB	19.9	Cold Water Fish, Aquatic Life
Bear River	WYBR160101010106_01	Mill Creek	Tributary to upper Bear River	2AB	20.9	Cold Water Fish, Aquatic Life
Bear River	WYBR160101010201_01	Bear River	Bear River above Sulphur Creek	2AB	51.3	Cold Water Fish, Aquatic Life
Bear River	WYBR160101010301_01	Pleasant Valley Creek	Watershed above Crompton Reservoir	3B	35.6	Aquatic Life
Bear River	WYBR160101020201_01	Hobble Creek	Hobble Creek watershed excluding Coantag Creek Drainage	2AB	66.5	Cold Water Fish, Aquatic Life
Bear River	WYBR160101020201_02	Coantag Creek	Tributary to Hobble Creek	2AB	35.0	Cold Water Fish, Aquatic Life
Bear River	WYBR160101020204_01	Smiths Fork	Smiths Fork above Mill Creek	2AB	138.0	Cold Water Fish, Aquatic Life
Bear River	WYBR160101020303_01	Salt Creek	Salt Creek Thomas Fork watershed above Idaho Line	2AB	59.8	Cold Water Fish, Aquatic Life
Bear River	WYBR160101020304_00	Giraffe Creek	Tributary to Salt Creek below Idaho line	2AB	19.3	Cold Water Fish, Aquatic Life
Cheyenne River	WYCR101201010000_01	Antelope Creek	From Cheyenne River upstream to headwaters	3B	78.5	Aquatic Life
Cheyenne River	WYCR101201030000_01	Cheyenne River	From Lance Creek upstream to Dry Fork Cheyenne River	2ABww	88.2	Warm Water Fish, Aquatic Life
Cheyenne River	WYCR101201030200_01	Black Thunder Creek	From Cheyenne River Upstream to Headwaters	3B	74.6	Aquatic Life
Cheyenne River	WYCR101201060100_01	Cheyenne River	From South Dakota Line upstream to Lance Creek	2ABww	19.4	Warm Water Fish, Aquatic Life
Cheyenne River	WYCR101201070103_01	Poison Creek	Tributary to Beaver Creek near Upton	3B	7.3	Aquatic Life, Wildlife
Green River	WYGR140401010200_01	Green River	Upper Green River Drainage below Green River Lakes	2AB	352.0	Cold Water Fish, Aquatic Life

Basin	ID 305B	Name	Location	Class	Miles/ Acres	Supported Use(s)
Green River	WYGR140401011102_00	LaBarge Creek	Upper LaBarge Creek Drainage	2AB	93.6	Cold Water Fish, Aquatic Life
Green River	WYGR140401011103_01	Rock Creek	Tributary to LaBarge Creek	2AB	8.4	Cold Water Fish, Aquatic Life
Green River	WYGR140401011302_00	Fontenelle Creek	Upper Fontenelle Creek Drainage	2AB	127.7	Cold Water Fish, Aquatic Life
Green River	WYGR140401011306_01	Fontenelle Creek	Lower Fontenelle Creek	2AB	13.3	Cold Water Fish, Aquatic Life
Green River	WYGR140401020203_00	New Fork River	Watershed between Green River and New Fork Lakes	2AB	37.0	Cold Water Fish, Aquatic Life
Green River	WYGR140401020203_00	New Fork River	Watershed between Green River and New Fork Lakes	2AB	217.7	Cold Water Fish, Aquatic Life
Green River	WYGR140401020403_01	Pole Creek	Tributary to New Fork River	2AB	24.7	Cold Water Fish, Aquatic Life
Green River	WYGR140401040407_01	Big Sandy River	From Green River up to Little Sandy River	2AB	44.0	Cold Water Fish, Aquatic Life
Green River	WYGR140401070201_01	East Fork Smiths Fork	From confluence with West Fork upstream to Utah Line.	2AB	24.6	Cold Water Fish, Aquatic Life
Green River	WYGR140401070203_01	West Fork Smiths Fork	From confluence with East Fork upstream to Utah Line.	2AB	28.4	Cold Water Fish, Aquatic Life
Green River	WYGR140401070600_01	Hams Fork	Watershed above Kemmerer except Willow Creek	2AB	117.6	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500030104_00	North Fork Little Snake River	From Colorado state line up to headwaters	2AB	36.2	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500030109_03	Lost Creek	From confluence with West Fork Battle Creek upstream	2AB	4.9	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500030401_01	Savery Creek East Fork	East Fork Savery Creek drainage including Hatch Creek and above.	2AB	16.6	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500030402_01	Dirtyman Fork	Lower Dirtyman Fork drainage	2AB	8.0	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500030405_01	Little Savery Creek	From McCarty Creek an undetermined distance downstream below Grizzly Ranch	2AB	4.2	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500030407_01	Big Sandstone Creek	Big Sandstone Creek Drainage including Deep Creek	2AB	32.6	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500030408_03	Loco Creek	Loco Creek drainage except West Fork	2AB	8.4	Cold Water Fish, Aquatic Life

Basin	ID 305B	Name	Location	Class	Miles/ Acres	Supported Use(s)
Little Snake	WYLS140500040101_01	Muddy Creek	Muddy Creek drainage above Littlefield Creek	2AB	21.1	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500040101_02	Littlefield Creek	Tributary to Muddy Creek	2AB	10.4	Cold Water Fish, Aquatic Life
Little Snake	WYLS140500040102_02	McKinney Creek	McKinney Creek drainage above Eagle Creek	2AB	23.2	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020000_01	North Platte River	From Sage Creek upstream to Colorado line	1	80.1	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020105_01	Smith North Creek	Smith North Creek drainage tributary to Douglas Creek	2AB	5.3	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020105_02	Muddy Creek	Muddy Creek drainage tributary to Douglas Creek	2AB	9.1	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020105_03	Douglas Creek	From Pelton Creek upstream to Muddy Creek	2AB	14.7	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020107_01	Douglas Creek	From North Platte River upstream to Pelton Creek	1	35.6	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020203_01	French Creek	French Creek drainage tributary to the North Platte River	2AB	67.5	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020303_01	Big Creek	Big Creek on National Forest	2AB	39.7	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020500_01	Encampment River	Encampment River Tributaries above North Fork, including North Fork, Miners Creek, East Fork and West Fork drainages, excluding Hog Park Creek	2AB	98.2	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020504_01	Encampment River	Encampment River from Purgatory Gulch upstream to East and West Forks	1	9.3	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020505_01	Hog Park Creek South Fork	From Hog Park Creek upstream to Colorado line	2AB	1.9	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020508_01	Encampment River	From North Platte River up to Purgatory Gulch	2AB	17.9	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020703_01	South Spring Creek	South Spring Creek above Centennial Creek	2AB	43.6	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020800_01	Jack Creek	Jack Creek and Tributaries	2AB	130.2	Cold Water Fish, Aquatic Life
North Platte	WYNP101800020903_01	Sage Creek	From confluence with North Platte River to State Hwy 71.	2AB	14.1	Cold Water Fish, Aquatic Life

Basin	ID 305B	Name	Location	Class	Miles/ Acres	Supported Use(s)
North Platte	WYNP101800040100_01	Medicine Bow River	Upper Medicine Bow River drainage upstream from and including the East Fork drainage	2AB	71.1	Cold Water Fish, Aquatic Life
North Platte	WYNP101800040201_01	Rock Creek	Rock Creek drainage from Overland Creek upstream to headwaters	2AB	56.0	Cold Water Fish, Aquatic Life
North Platte	WYNP101800050502_01	Shirley Basin Reservoir	Shirley Basin NW S12 T26N R80W	2AB	17.0	Cold Water Fish, Aquatic Life
North Platte	WYNP101800060204_01	Willow Creek	Tributary to Sweetwater River near South Pass	2AB	36.0	Cold Water Fish, Aquatic Life
North Platte	WYNP101800080905_01	Horseshoe Creek	From Spring Creek upstream an undetermined distance	2AB	12.5	Cold Water Fish, Aquatic Life
North Platte	WYNP101800080905_02	Horseshoe Creek	From the North Platte River upstream approximately 2.5 miles	2AB	2.5	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100200_01	Big Laramie River	Big Laramie River drainage above Jelm	2AB	71.6	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100204_01	Miller Lake	On Evans Creek near Fox Park	2AB	9.4	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100403_01	Meeboer Lake	Laramie Plains Lake Complex	2AB	40.0	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100600_01	Little Laramie River	Little Laramie River Drainage above Millbrook	2AB	152.6	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100602_01	Little Laramie River South Fork	Above National Forest Boundary	2AB	6.0	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100603_01	Hanging Lake	Nash Fork Watershed NWNE S20 T16N R78W	2AB	4.9	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100603_02	Snowy Range Lakes	Lakes in upper North Fork Little Laramie drainage	2AB	346.7	Cold Water Fish, Aquatic Life
North Platte	WYNP101800100606_01	Mill Creek Middle Fork	Above National Forest Boundary	2AB	2.9	Cold Water Fish, Aquatic Life
North Platte	WYNP101800110900_02	Chugwater Creek	Above Antelope Gap Road	2AB	77.3	Cold Water Fish, Aquatic Life
North Platte	WYNP101800110906_01	Chugwater Creek	From Laramie River upstream to Antelope Gap Road	2AB	10.4	Cold Water Fish, Aquatic Life
North Platte	WYNP101800120100_01	Horse Creek	Above South Fork Horse Creek	2AB	45.5	Cold Water Fish, Aquatic Life
North Platte	WYNP101800120300_01	Bear Creek	Bear Creek drainage tributary to Horse Creek	2AB	313.5	Cold Water Fish, Aquatic Life

Basin	ID 305B	Name	Location	Class	Miles/ Acres	Supported Use(s)
North Platte	WYNR101500020104_01	Silver Springs Creek	All of Silver Springs Creek, Tributary to the Niobrara River	3B	16.8	Aquatic Life
Powder River	WYPR100902010101_01	Rock Creek	From Middle Fork Powder River to headwaters	2AB	26.4	Cold Water Fish, Aquatic Life
Powder River	WYPR100902010102_01	Powder River, Middle Fork	Above Buffalo Creek	1	26.4	Cold Water Fish, Aquatic Life
Powder River	WYPR100902010202_00	Beaver Creek	From Blue Creek to Headwaters, excluding Red Draw drainage	2AB	19.0	Cold Water Fish, Aquatic Life
Powder River	WYPR100902010202_01	Blue Creek	Tributary to Beaver Creek; Lower Reach	2AB	8.8	Cold Water Fish, Aquatic Life
Powder River	WYPR100902010206_01	Beartrap Creek	Upper Beartrap Creek including Sawmill Creek	2AB	48.8	Cold Water Fish, Aquatic Life
Powder River	WYPR100902010301_01	Webb Creek	Tributary to North Fork Powder River	2AB	11.9	Cold Water Fish, Aquatic Life
Powder River	WYPR100902020100_01	Ninemile Creek	Western tributary to upper Powder River	3B	156.4	Aquatic Life
Powder River	WYPR100902020104_01	Fourmile Creek	Tributary to upper Powder River near Sussex	3B	43.1	Aquatic Life
Powder River	WYPR100902020602_01	Flying E Creek	Tributary to upper Powder River	3B	36.7	Aquatic Life
Powder River	WYPR100902050101_01	Pole Creek	Tributary to North Fork Crazy Woman Creek	2AB	8.3	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050102_02	Little North Fork Crazy Woman Creek	From North Fork Crazy Woman Creek Upstream	2AB	19.3	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050103_01	Billy Creek	Tributary to Muddy Creek	2AB	13.2	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050106_01	Doyle Creek	Above Taylor Creek	2AB	8.6	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050107_01	Poison Creek	Middle Fork Crazy Woman Creek to Headwaters	2AB	22.8	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050108_00	Crazy Woman Creek Middle Fork	From North Fork Crazy Woman Creek to Headwaters, excluding Doyle Creek	2AB	53.0	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050110_01	Beaver Creek	From South Fork Crazy Woman Creek to Headwaters	2AB	34.7	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050110_02	Pole Creek	Tributary to Beaver Creek	2AB	12.0	Cold Water Fish, Aquatic Life
Powder River	WYPR100902050204_01	Crazy Woman Creek	Between Walker Draw and South Fork Crazy Woman Creek	2AB	24.5	Cold Water Fish, Aquatic Life

Basin	ID 305B	Name	Location	Class	Miles/ Acres	Supported Use(s)
Powder River	WYPR100902060000_01	Clear Creek	Headwaters down to Powder River	2AB	196.1	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060103_01	Hunter Creek	Tributary to North Clear Creek	2AB	1.9	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060106_01	French Creek	Tributary to Clear Creek	2AB	22.3	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060201_01	North Fork Rock Creek	From South Fork Rock Creek to headwaters	2AB	12.0	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060202_01	Rock Creek	From Clear Creek up to South Fork Rock Creek	2AB	18.1	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060302_01	South Piney Creek	From Piney Creek upstream, excluding Kearney Creek	2AB	32.9	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060304_01	Little Piney Creek	From Piney Creek Upstream	2AB	13.6	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060305_01	Shell Creek North and South Forks	Above Shell Creek Reservoir	3B	16.7	Aquatic Life
Powder River	WYPR100902060403_01	Piney Creek	From Clear Creek upstream to North and South Forks Piney Creek	2AB	31.3	Cold Water Fish, Aquatic Life
Powder River	WYPR100902060404_01	Boxelder Creek	From Piney Creek upstream to its headwaters	3B	42.1	Aquatic Life
Snake River	WYSR170401010503_01	Spread Creek North Fork	North Fork Spread Creek watershed	2AB	27.7	Cold Water Fish, Aquatic Life
South Platte	WYSP101900090101_01	Crow Creek Middle	Undetermined distance above and below FS Road 700	2AB	1.6	Recreation
Tongue River	WYTR100901010104_01	Prune Creek	Above and below Sibley Lake	2AB	5.4	Cold Water Fish, Aquatic Life
Tongue River	WYTR100901010107_01	Little Tongue River	From Frisbee Ditch upstream	2AB	26.7	Cold Water Fish, Aquatic Life
Tongue River	WYTR100901010203_01	West Fork Big Goose Creek	Above and below Coney Creek	2AB	29.6	Cold Water Fish, Aquatic Life
Tongue River	WYTR100901010203_02	Coney Creek	Coney Creek, including tributaries	2AB	13.5	Cold Water Fish, Aquatic Life
Yellowstone	WYYR100700060106_01	Squaw Creek	Tributary to Clarks Fork	2AB	9.4	Cold Water Fish, Aquatic Life
Yellowstone	WYYR100700060304_01	Dead Indian Creek	From Clarks Fork upstream to Dry Fork	2AB	6.6	Cold Water Fish, Aquatic Life

**Table 6. Waters Delisted from 2006 303(d) List**

<b>Basin</b>	<b>ID 305(b)</b>	<b>Name</b>	<b>Location</b>	<b>Class</b>	<b>Miles</b>	<b>Cause(s) on 2006 303(d) List</b>	<b>Reason for Removal</b>
Bighorn River	WYBH100800070609_01	Cottonwood Creek	From Bighorn River up to Hamilton Dome Oil Field.	2AB	33.0	Chloride, Selenium	New Site Specific Criteria
Cheyenne River	WYCR101201070103_01	Poison Creek	Tributary to Beaver Creek near Upton.	3B	7.3	Oil and Grease	Meets Applicable Water Quality Standards
North Platte	WYNP101800020903_01	Sage Creek	From confluence with North Platte River to State Hwy 71.	2AB	14.1	Habitat	Meets Applicable Water Quality Standards
North Platte	WYNP101800110906_01	Chugwater Creek	From Laramie River upstream to Antelope Gap Road	2AB	10.4	Habitat, Sediment	Meets Applicable Water Quality Standards
Powder River	WYPR100902040300_01	Salt Creek	From Powder River upstream to Castle Creek.	2C	21.4	Chloride	New Site Specific Criterion
Powder River	WYPR100902050305_01	Crazy Woman Creek	From Powder River to an undetermined distance upstream.	2AB	9.3	Manganese	Stream at natural potential
Powder River	WYPR100902060305_01	Shell Creek North and South Forks	Above Shell Creek Reservoir.	3B	16.7	Habitat	Meets Applicable Water Quality Standards
Snake River	WYSR170401010503_01	Spread Creek North Fork	Reach in S13&14 T44N R111W.	2AB	0.8	Habitat	Meets Applicable Water Quality Standards
South Platte	WYSP101900090101_01	Crow Creek Middle	Undetermined distance above and below FS Road 700.	2AB	1.6	Fecal Coliform	Meets Applicable Water Quality Standards

**Table 7. Category 4 Waters**

<b>Basin</b>	<b>ID 305(b)</b>	<b>Name</b>	<b>Location</b>	<b>Class</b>	<b>Miles</b>	<b>Cause(s) on 2006 303(d) List</b>
Yellowstone River	YR10070006	Clarks Fork Yellowstone River	Montana border. Impairment undetermined distance below.	1	-	Cadmium, Copper, Silver
Bighorn River	WYBH100800070607_01	Grass Creek	Grass Creek above irrigation withdrawal in NENE S23 T46N R99W	2AB	65.3	Cold Water Fish, Aquatic Life
Bighorn River	WYBH100800100502_01	Crooked Creek	Crooked Creek from irrigation diversion in SWNW S29 T58N R95W upstream to Montana line	2AB	3.8	Cold Water Fish, Aquatic Life
North Platte	WYNP101800080905_01	Horseshoe Creek	From Spring Creek upstream an undetermined distance	2AB	12.5	Cold Water Fish, Aquatic Life

## 2008 303(d) Waters Requiring TMDLs

Between 1998 and 2006, Wyoming split the 303(d) List into three tables; beginning in 2008, the 303(d) list will be contained in one table. Because the presence of a permitted discharge does not necessarily imply a water quality problem, and Waste Load Allocations (WLAs) by themselves are not complete TMDLs, Table B - Waters with Wyoming Pollutant Discharge Elimination System (WYPDES) Discharge Permits containing current WLAs has been eliminated. Tables A and C have been combined into a single 303(d) List of Waters Requiring TMDLs.

### Summary of 2008 303(d) List Changes

As more data became available, the extent of impaired reaches and/or the degree of impairment (e.g. change in status from threatened to not supporting) for a number of waters was changed. These changes are described in the “River Basin Descriptions and Summaries of Water Quality Conditions” sections above, as well as on the 303(d) List. Nine new water/pollutant combinations have been added to the 2008 303(d) List and eight water/pollutant combinations have been removed:

Ammonia and chloride were added as pollutants on the 303(d) List for the Belle Fourche River between Keyhole Reservoir to an undetermined distance above Donkey Creek.

Cottonwood Creek, below the Hamilton Dome oil field was delisted from the 303(d) List due to site specific criteria for chloride and selenium.

Dry Gulch, tributary to the Shoshone River, has been added to the 303(d) List for exceedences of the *E. coli* criterion.

Poison Creek, near Osage has been delisted from the 303(d) List since it is supporting its aquatic life uses.

Sage Creek, in the Upper North Platte River Sub-basin has been delisted from the 303(d) List since it is supporting its aquatic life uses, given the natural potential of its watershed.

Chugwater Creek has been delisted from the 303(d) List since the bank erosion, which had been causing excessive sedimentation, has been mitigated due to riparian fencing and a change in management practices.

Ammonia was added as a pollutant on the 303(d) List for Wheatland Creek below the Wheatland WWTF.

Murphy and Posey Creeks, in the South Fork Powder Sub-basin, have been added to the 303(d) List for exceedences of the selenium criterion.

Chloride has been removed as a pollutant on Salt Creek because the specific chloride criterion is met, however selenium has been added as a pollutant on the 303(d) List.

Piney-Cruse Ditch in Story has been added to the 303(d) List for exceedences of the *E. coli* criterion.

South Fork and North Fork Shell Creeks have been removed from the 303(d) list because they are fully

supporting its aquatic life uses.

North Fork Spread Creek has been removed from the 303(d) list because it is fully supporting its aquatic life uses.

Stump Creek, tributary to the Salt River, has been added to the 303(d) List for exceedences of the *E. coli* criterion.

Middle Crow Creek has been delisted from the 303(d) List since three years of weekly *E. coli* monitoring show no exceedence of the criterion.

EPA has determined North Branch of North Fork Crow Creek does not qualify for Category 4B and it has been returned to the 303(d) List.

## **TMDL Prioritization**

EPA guidance and programmatic conditions call for an 8-13 year maximum timeline for TMDL finalization. The Assessment Methodology outlines the general criteria employed by DEQ for prioritizing waters for TMDL development. Prioritization focuses on pollution hazards on human and environmental health. Prioritization will also be based on a combination of original listing date and development and implementation of Watershed-based Plans. Watershed-based Plans identify the problems, loads, sources, solutions, and describe an implementation strategy to ensure that designated uses will be restored. In many cases, a listed water will contain characteristics that place it into more than one priority rating category. In those cases, all the applicable factors will be examined and weighted in order to arrive at a date for TMDL completion. While the priorities established using those criteria will be generally followed, circumstances may dictate adjustments, based on sound rationale, such as petitions from other entities, efficiency and geographic practicality of addressing high and low priorities at the same time. Where local stakeholder groups have committed, since the last listing process, to develop a Watershed-based Plan, the segment will be moved to a lower priority, based on the initial listing date, and the local group given time for the Watershed-based Plan action items to bring the water to full use attainment within 10 years of the initial listing date.

Prioritizing criteria have little to do with determining use support, but have traditionally been included in the “Assessment Methodology”. In 2008, DEQ expects to update its TMDL Workplan to address waters on the 303(d) List. At that time, the TMDL prioritization criteria are expected to become part of that Workplan and will be removed from the “Assessment Methodology” document. The Assessment Methodology outlines the general prioritization categories of High, Medium, or Low Priority, which are used as guidelines to set specific dates for TMDL development. A “high” Priority indicates TMDLs are scheduled to be finalized within two years, and a “medium” priority indicates TMDLs are scheduled to be finalized within four years. Time necessary to finalize a TMDL usually means TMDL development must begin before the water is prioritized as “high”. All waters will be prioritized as “high”, regardless of previous prioritization no later than 10 years following the listing date. To clarify when TMDLs will be developed, the expected date of TMDL completion is on the 303(d) List, rather than a High, Medium, or Low Priority. On those waters with later dates of TMDL completion, the date is an approximation and may be changed due to changes in circumstances such as new listings, delistings, geographic practicality, stakeholder participation, etc.



## 2008 303(d) List of Waters Requiring TMDLs

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
Bear River	WYBR160101010303_01	Bear River	2AB	From Woodruff Narrows Reservoir up to Sulphur Creek.	36.0	Aquatic Life, Cold Water Fish	Not Supporting	Sediment	Habitat Modification	2002	2010
Bear River	WYBR160101010801_01	Bridger Creek	3B	Watershed upstream of Utah line.	14.5	Aquatic Life	Threatened	Habitat	Grazing	1998	2010
Belle Fourche	WYBF101202010501_01	Belle Fourche River	2ABww	From Donkey Creek upstream to an undetermined distance above Rush Creek.	5.4	Recreation	Not Supporting	<i>E. coli</i>	Unknown	1996	2010
Belle Fourche	WYBF101202010504_00	Belle Fourche River	2ABww	From Keyhole Reservoir upstream to Donkey Creek.	21.2	Recreation	Not Supporting	<i>E. coli</i>	Unknown	1996	2010
Belle Fourche	WYBF101202010504_00	Belle Fourche River	2ABww	From Keyhole Reservoir upstream to Donkey Creek.	21.2	Aquatic Life, Warm Water Fish	Not Supporting	Ammonia, Chloride	Unknown	2008	2010
Belle Fourche	WYBF101202010600_01	Donkey Creek	3B	From Belle Fourche River upstream to an undetermined distance above Antelope Butte Creek.	56.0	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2010
Belle Fourche	WYBF101202010601_01	Gillette Fishing Lake	2AB	Gillette Fishing Lake.	15.4	Aquatic Life, Cold Water Fish	Not Supporting	Phosphate, Sediment	Non-Point Source, Stormwater	1996	2009

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
Belle Fourche	WYBF101202010602_01	Stonepile Creek	3B	From confluence with Donkey Creek upstream an undetermined distance.	7.5	Recreation	Not Supporting	Fecal Coliform	Unknown, Stormwater	2002	2010
Belle Fourche	WYBF101202010904_00	Belle Fourche River	2ABww	From Arch Creek downstream to Sourdough Creek.	58.5	Recreation	Not Supporting	Fecal Coliform	Unknown	1996	2010
Bighorn	WYBH100800030207_01	Popo Agie River, Middle Fork	2AB	Undetermined distances upstream and downstream of City of Lander.	4.0	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Bighorn	WYBH100800050202_01	Ocean Lake	2ABww	Ocean Lake.	6075.8	Aquatic Life, Warm Water Fish	Not Supporting	Sediment	Irrigated Crop Production, Non-Point Source	1996	2008
Bighorn	WYBH100800050404_01	Poison Creek	2AB	From Boysen Reservoir upstream an undetermined distance.	2.1	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Bighorn	WYBH100800050607_01	Muddy Creek	2AB	From Boysen Reservoir upstream to Wind River Indian Reservation	11.1	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Bighorn	WYBH100800070305_01	Owl Creek	2AB	Confluence with Bighorn River upstream an undetermined distance.	3.6	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800070500_01	Kirby Creek	2C	Confluence with the Bighorn River upstream to an undetermined distance above Lake Creek.	21.9	Recreation	Threatened	Fecal Coliform	Unknown	2002	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
Bighorn	WYBH100800070809_01	Nowater Creek	3B	Confluence with Bighorn River upstream an undetermined distance.	6.6	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800070909_01	Fifteenmile Creek	3B	Confluence with Bighorn River upstream an undetermined distance.	2.2	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800071000_01	Bighorn River	2AB	Confluence with Nowood River upstream an undetermined distance above the City of Worland	36.9	Recreation	Threatened	<i>E. coli</i>	Unknown	2002	L
Bighorn	WYBH100800071000_02	Bighorn River	2AB	From Greybull River upstream to Nowood River.	16.1	Recreation	Not Supporting	Fecal Coliform	Unknown	2000	M
Bighorn	WYBH100800071001_01	Sage Creek	3B	Confluence with Slick Creek upstream an undetermined distance.	9.7	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800071001_02	Slick Creek	3B	Confluence with Bighorn River upstream an undetermined distance	6.2	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800080607_01	Paint Rock Creek	2AB	Confluence with Nowood River upstream an undetermined distance.	5.2	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800080705_01	Nowood River	2AB	From confluence with Bighorn River upstream an undetermined	12.3	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
				distance.							
Bighorn	WYBH100800090405_01	Greybull River	2AB	From confluence with Bighorn River upstream to the Sheets Flat bridge.	38.0	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800100102_01	Granite Creek	2AB	From confluence with Shell Ck upstream to an undetermined point near Antelope Butte Ski Area.	5.8	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Bighorn	WYBH100800100204_01	Beaver Creek	2AB	From Shell Creek upstream an undetermined distance.	7.1	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800100206_01	Shell Creek	2AB	From confluence with Bighorn River upstream an undetermined distance.	5.6	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800100301_01	Bighorn River	2AB	From Greybull River downstream an undetermined distance above Big Horn Lake.	10.5	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800110204_01	Dry Creek	2ABww	From Bighorn River upstream an undetermined distance.	4.4	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800140107_01	Dry Gulch	3B	From confluence with Shoshone River upstream an undetermined distance.	6.6	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2008	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
Bighorn	WYBH100800140206_01	Bitter Creek	2AB	From Shoshone River upstream an undetermined distance above Powell.	13.9	Recreation	Not Supporting	Fecal Coliform	Unknown	2000	M
Bighorn	WYBH100800140303_01	Whistle Creek	3B	From confluence with Shoshone River upstream an undetermined distance.	8.7	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800140307_01	Foster Gulch	2C	Confluence with Shoshone River upstream an undetermined distance.	2.0	Recreation	Threatened	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800140407_01	Polecat Creek	2AB	From Sage Creek upstream an undetermined distance.	2.6	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800140408_01	Sage Creek	2AB	From Shoshone River upstream an undetermined distance above Big Wash.	14.0	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800140408_02	Big Wash	3B	From Sage Creek upstream to Sidon Canal.	3.2	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Bighorn	WYBH100800140504_00	Shoshone River	2AB	From confluence with Big Horn Lake upstream an undetermined distance.	9.7	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Green River	WYGR140401050506_01	Bitter Creek	2C	From Green River upstream to Point of Rocks.	21.6	Recreation	Not Supporting	Fecal Coliform	Unknown	2000	M
Green River	WYGR140401050506_01	Bitter Creek	2C	From Green River upstream to Point of Rocks.	21.6	Aquatic Life, Non-	Not Supporting	Chloride	Natural Sources, Unknown	2002	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
						Game Fish					
Green River	WYGR140401050808_01	Killpecker Creek	3B	From Bitter Creek upstream to Reliance.	6.9	Recreatio n	Not Supporting	Fecal Coliform	Unknown	2000	M
Green River	WYGR140401070106_01	Blacks Fork	2AB	From confluence with Smiths Fork upstream to Millburne.	24.0	Recreatio n	Not Supporting	<i>E. coli</i>	Unknown	2000	2011
Green River	WYGR140401070205_01	Willow Creek	2AB	From confluence with Smiths Fork upstream to Utah Line.	48.5	Aquatic Life, Cold Water Fish	Threatened	Habitat	Grazing	1998	2011
Green River	WYGR140401070208_00	Smiths Fork	2AB	From confluence with Cottonwood Creek upstream to East and West Smiths Fork.	29.6	Recreatio n	Not Supporting	Fecal Coliform	Unknown	2002	2011
Green River	WYGR140401070208_01	Smiths Fork	2AB	From confluence with Blacks Fork to Cottonwood Creek.	3.6	Aquatic Life, Cold Water Fish	Not Supporting	Habitat	Unknown	2000	2011
Green River	WYGR140401070208_01	Smiths Fork	2AB	From confluence with Blacks Fork to Cottonwood Creek	3.6	Recreatio n	Not Supporting	<i>E. coli</i>	Unknown	2002	2011
Green River	WYGR140401070403_01	Blacks Fork	2AB	From confluence with Ham's Fork upstream to Smiths Fork.	44.1	Recreatio n	Not Supporting	<i>E. coli</i>	Unknown	2000	2011
Green River	WYGR140401070701_01	Hams Fork	2AB	From Kemmerer- Diamondville downstream an undetermined distance.	7.8	Aquatic Life, Cold Water Fish	Not Supporting	pH	Municipal WWTF	1996	2009

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
Little Snake	WYLS140500030109_01	Haggarty Creek	2AB	From Ferris-Haggarty Mine downstream to West Fork Battle Creek.	5.9	Aquatic Life, Cold Water Fish	Not Supporting	Cadmium, Copper, Silver	Hardrock Mining	1996	2008
Little Snake	WYLS140500030109_02	Battle Creek West Fork	2AB	From Battle Creek upstream to Haggarty Creek.	4.6	Aquatic Life, Cold Water Fish	Not Supporting	Copper	Hardrock Mining	2000	2008
Little Snake	WYLS140500030408_01	Savery Creek	2AB	From Little Sandstone Creek downstream to Little Snake River.	11.4	Aquatic Life, Cold Water Fish	Threatened	Habitat	Grazing	1998	M
Little Snake	WYLS140500030408_02	Loco Creek West Fork	2AB	West Fork watershed tributary to Loco Creek.	2.8	Aquatic Life, Cold Water Fish	Threatened	Habitat Nutrients, Temperature	Grazing	1996	M
Little Snake	WYLS140500040102_01	McKinney Creek	2AB	From Muddy Creek upstream to Eagle Creek.	5.1	Aquatic Life, Cold Water Fish	Threatened	Habitat	Grazing	1996	M
Little Snake	WYLS140500040103_01	Muddy Creek	2AB	From Alamosa Gulch upstream to Littlefield Creek.	11.4	Aquatic Life, Cold Water Fish	Threatened	Habitat	Grazing	1996	M
Little Snake	WYLS140500040104_01	Muddy Creek	2C	West of State Hwy 789.	15.4	Aquatic Life, Non-Game Fish	Threatened	Habitat	Grazing	1996	M
North Platte	WYNP101800060603_01	Crooks Creek	2AB	From SW NE S18 T28N R92W undetermined	1.3	Aquatic Life, Cold	Not Supporting	Oil and Grease	Petroleum Production	1998	2008

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
				distance downstream.		Water Fish					
North Platte	WYNP101800070300_01	North Platte River	2AB	Exceedences measured at Casper. Impairment extends undetermined distance upstream and downstream.	41.8	Aquatic Life, Cold Water Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	1998	M
North Platte	WYNP101800070302_01	Poison Spring Creek	3B	In Kendrick Reclamation Project below Casper Canal.	10.4	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070302_02	Rasmus Lee Lake	3B	In Kendrick Reclamation Project.	85.2	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070302_03	Goose Lake	3B	In Kendrick Reclamation Project.	30.1	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070303_01	Oregon Trail Drain	3B	In Kendrick Reclamation Project.	8.4	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070406_01	Poison Spider Creek	2AB	From North Platte River upstream one mile in Kendrick Reclamation Project.	1.0	Aquatic Life, Cold Water Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
North Platte	WYNP101800070406_02	Poison Spider Creek	2C	From one mile upstream of North Platte River to six miles upstream of North Platte River in Kendrick Reclamation Project.	5.0	Aquatic Life, Non-Game Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070406_03	Poison Spider Creek	3B	Upstream from a point six miles upstream of North Platte River in Kendrick Reclamation Project.	6.0	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070503_01	Illco Pond	3B	NE S13 T35N R81W along railroad tracks	1.0	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070504_01	Casper Creek	2AB	In Kendrick Reclamation Project between Casper Canal and the North Platte River.	21.7	Aquatic Life, Cold Water Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800070703_01	Thirty-three Mile Reservoir	3B	On South Fork Casper Creek in Kendrick Reclamation Project.	30.2	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources	2000	M
North Platte	WYNP101800110502_01	Wheatland Creek	2C	Impairment undetermined distance above and below Hwy 320.	4.4	Aquatic Life, Non-Game Fish	Not Supporting	Ammonia, pH	Municipal WWTF	1996	M
North Platte	WYNP101800110502_01	Wheatland Creek	2C	Impairment undetermined	4.4	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
				distance above and below Hwy 320.							
North Platte	WYNP101800110502_02	Rock Creek	2C	Above Town of Wheatland.	16.5	Recreation	Not Supporting	Fecal Coliform	Unknown	2002	L
Powder River	WYPR100902020102_00	Powder River	2ABww	From Salt Creek to South Fork Powder River.	19.1	Aquatic Life, Warm Water Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources, Unknown	2000	M
Powder River	WYPR100902020103_01	Powder River	2ABww	From Salt Creek downstream an undetermined distance above Willow Creek.	22.0	Warm Water Fish	Not Supporting	Chloride	Petroleum Production	1998	M
Powder River	WYPR100902020103_01	Powder River	2ABww	From Salt Creek downstream an undetermined distance above Willow Creek.	22.0	Aquatic Life, Warm Water Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources, Unknown	2000	M
Powder River	WYPR100902020600_01	Powder River	2ABww	From an undetermined distance above Willow Creek downstream to the confluence with Crazy Woman Creek.	116.2	Aquatic Life, Warm Water Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources, Unknown	2000	M
Powder River	WYPR100902020808_01	Middle Prong Wild Horse Creek Lower	3B	Confluence with Wild Horse Creek upstream an undetermined distance	4.6	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2006	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
Powder River	WYPR100902030400_01	South Fork Powder River	2C	From confluence with Middle Fork upstream an undetermined distance above Lone Tree Creek.	57.1	Non-Game Fish, Aquatic Life, Wildlife	Not Supporting	Selenium	Unknown	2006	L
Powder River	WYPR100902030403_01	Willow Creek	2AB	From confluence with South Fork Powder R. to an undetermined distance upstream.	10.7	Aquatic Life, Cold Water Fish, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources, Unknown	2006	L
Powder River	WYPR100902030404_01	Posey Creek	3B	Tributary to South Fork Powder River.	8.0	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources, Unknown	2008	L
Powder River	WYPR100902030407_01	Murphy Creek	3B	Tributary to South Fork Powder River.	12.0	Aquatic Life, Wildlife	Not Supporting	Selenium	Irrigated Crop Production, Natural Sources, Unknown	2008	L
Powder River	WYPR100902040300_01	Salt Creek	2C	From Powder River upstream to Castle Creek.	21.4	Non-Game Fish, Aquatic Life, Wildlife	Not Supporting	Selenium	Petroleum Production, Natural Sources, Unknown	2008	L
Powder River	WYPR100902040300_01	Salt Creek	2C	Downstream of Oil Fields		Non-game Fish, Aquatic Life	Threatened	Oil Spills	Petroleum Production	1996	M
Powder River	WYPR100902050100_01	, North Fork Crazy Woman	2AB	Reaches within T49N R82W.	28.0	Aquatic Life, Cold Water	Threatened	Habitat, Nutrients, Bioindicators	Grazing	1996	M

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
		Creek				Fish					
Powder River	10090205	Crazy Woman Creek	2ABW W	From Powder R to an undetermined distance upstream.		Drinking Water	Not Supporting	Manganese	Natural, Undetermined 2002	2002	M
Powder River	WYPR100902060303_01	North Piney Creek	2AB	Confluence with South Piney Creek upstream to an undetermined location below SW, NW Sec 12, T52N, R84W.	6.4	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2006	L
Powder River	WYPR100902060303_02	Dalton Ditch	3B	Within and near Town of Story.	0.3	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2006	L
Powder River	WYPR100902060303_03	Piney-Cruse Ditch	3B	Within and near Town of Story.	2.0	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2008	L
Powder River	WYPR100902080500_01	Little Powder River	2AB	Wyoming/Montana state line upstream an undetermined distance above Olmstead Creek.	15.9	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Snake River	WYSR170401030205_01	Flat Creek	1	Between Snake River and Cache Creek.	9.9	Aquatic Life, Cold Water Fish	Threatened	Habitat	Stormwater	2000	2010
Snake River	WYSR170401050203_01	Stump Creek	2AB	From Salt River upstream to Idaho Line.	5.2	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2008	L
Snake River	WYSR170401050309_01	Salt River	2AB	Undetermined distance upstream, downstream of Gaging Station (3.4 Miles NW of Etna).	7.5	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
South Platte	WYSP101900090104_01	Crow Creek North Branch North Fork	2AB	Exceedences measured at FS Road 701.	1.3	Recreation	Not Supporting	<i>E. coli</i>	Grazing	2004	L
South Platte	WYSP101900090107_01	Crow Creek	2AB	Impairment an undetermined distance above and below Cheyenne.	13.4	Aquatic Life, Cold Water Fish	Not Supporting	Ammonia	Unknown	1996	M
South Platte	WYSP101900090107_01	Crow Creek	2AB	From Dry Creek upstream an undetermined distance above Roundtop Road.	13.4	Recreation	Not Supporting	<i>E. coli</i>	Stormwater	1996	M
South Platte	WYSP101900090203_01	Crow Creek	2C	From Dry Creek an undetermined distance downstream.	6.3	Aquatic Life, Non-Game Fish	Not Supporting	Ammonia	Point Source	1996	M
South Platte	WYSP101900090203_01	Crow Creek	2C	From Dry Creek an undetermined distance downstream.	6.3	Recreation	Not Supporting	<i>E. coli</i>	Unknown	1996	M
Tongue River	WYTR100901010101_01	North Tongue River	1	From confluence of Bull Creek upstream an undetermined distance above Hwy 14A.	5.2	Recreation	Not Supporting	<i>E. coli</i>	Grazing	2004	L
Tongue River	WYTR100901010106_01	Columbus Creek	2AB	From confluence with Tongue River an undetermined distance above Highway 14.	3.4	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Tongue River	WYTR100901010106_02	Smith Creek	2AB	From confluence with Tongue River an undetermined	5.2	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
				distance above Dayton.							
Tongue River	WYTR100901010107_02	Little Tongue River	2AB	From confluence with Tongue River upstream to Frisbee Ditch.	5.7	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Tongue River	WYTR100901010108_01	Fivemile Creek	3B	From confluence with Tongue River an undetermined distance above Ranchester.	2.0	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2002	L
Tongue River	WYTR100901010110_01	Wolf Creek	2AB	From confluence with Tongue River an undetermined distance above County Road 67.	9.3	Recreation	Threatened	<i>E. coli</i>	Unknown	2002	L
Tongue River	WYTR100901010204_01	Park Creek	2AB	From Big Goose Creek to an undetermined distance upstream.	2.6	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009
Tongue River	WYTR100901010204_02	Rapid Creek	2AB	From Big Goose Creek to an undetermined distance upstream.	3.2	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009
Tongue River	WYTR100901010205_01	Big Goose Creek	2AB	From Sheridan to above Beckton.	18.7	Recreation	Not Supporting	<i>E. coli</i>	Unknown	1996	2009
Tongue River	WYTR100901010205_02	Beaver Creek	2AB	From Big Goose Creek to an undetermined distance upstream.	5.7	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009
Tongue River	WYTR100901010207_01	Sackett Creek	2AB	From Little Goose Creek to an undetermined distance upstream.	3.0	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009
Tongue River	WYTR100901010207_02	Jackson Creek	2AB	From Little Goose Creek to an undetermined distance upstream.	6.1	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
Tongue River	WYTR100901010208_01	Little Goose Creek	2AB	From Sheridan upstream to above Big Horn.	15.3	Recreation	Not Supporting	<i>E. coli</i>	Unknown	1996	2009
Tongue River	WYTR100901010208_01	Little Goose Creek	2AB	From Sheridan upstream to above Big Horn.	15.3	Aquatic Life, Cold Water Fish	Not Supporting	Habitat, Sediment	Stormwater	2006	2009
Tongue River	WYTR100901010208_02	McCormick Creek	2AB	From Little Goose Creek to an undetermined distance upstream.	2.1	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2004	2009
Tongue River	WYTR100901010208_03	Kruse Creek	2AB	From Little Goose Creek to an undetermined distance upstream.	2.5	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009
Tongue River	WYTR100901010209_01	Goose Creek	2AB	From confluence of Big and Little Goose Creeks an undetermined distance downstream.	12.6	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009
Tongue River	WYTR100901010209_01	Goose Creek	2AB	From confluence of Big and Little Goose Creeks an undetermined distance downstream.	12.6	Aquatic Life, Cold Water Fish	Not Supporting	Habitat, Sediment	Stormwater	2006	2009
Tongue River	WYTR100901010209_02	Soldier Creek	2AB	From Goose Creek to an undetermined distance upstream.	2.8	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2000	2009
Tongue River	WYTR100901010301_01	Tongue River	2AB	From Goose Creek downstream to Montana Line.	22.4	Cold Water Fish	Not Supporting	Temperature	Unknown	2002	L
Tongue River	WYTR100901010400_01	Prairie Dog Creek	2AB	Prairie Dog Creek above lower reach.	50.3	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2004	L
Tongue River	WYTR100901010402_01	Prairie Dog Creek	2AB	From Tongue River to an	6.3	Drinking Water	Not Supporting	Manganese	Natural Sources	2002	L

Basin	ID 305(b)	Name	Class	Location	Miles/ Acres	Uses	Use Support	Cause(s)	Source(s)	List Date	TMDL Date
				undetermined distance upstream.							
Tongue River	WYTR100901010402_01	Prairie Dog Creek	2AB	From Tongue River to an undetermined distance upstream.	6.3	Recreation	Not Supporting	<i>E. coli</i>	Unknown	2004	L

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